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Dedication

To my wife and my parents.

Abstract

My dissertation investigates the interaction between corporate finance and labor market. It contains three chapters.

Chapter 1 studies the strategic role of debt structure in improving the bargaining position of a firm's management relative to its non-financial stakeholders. Debt structure is essential for strategic bargaining because it affects the ease of renegotiating debt contracts and thus the credibility of bankruptcy threats. Debt structure is shown to be adjusted as a response to an increase in non-financial stakeholders' negotiation power. Using NLRB labor union election as a laboratory setting and employing a regression discontinuity design, we find that passing a labor union election leads to an increase in the ratio of public debt to total assets and a decrease in the ratio of bank debt to total assets in the following three years after elections, whereas there is no significant change in the level of total debt. The syndication size of newly issued bank loans increases while creditor ownership concentration decreases once the vote share for unions passes the winning threshold. Further analyses confirm that the debt structure adjustments after union certification are more likely driven by the strategic concerns of management rather than more constrained access to bank loans. Finally, we also show that the degree of wage concessions is strongly related to a firm's debt structure using the airline industry as an empirical setting.

Chapter 2 is co-authored with Tracy Yue Wang. In this study, we measure firms' exposures to skilled labor risk by the intensity of such discussions in their 10-Ks. We find that this measure effectively captures firm risk due to the mobility of skilled labor. We then examine the impact of skilled labor risk on firms' compensation policies. To overcome the reverse causality potentially present in the equilibrium relation between skilled labor risk and compensation policies, we use housing market factors that affect home owners' mobility as instruments for local firms' skilled labor risk, based on the insight that talents are likely homeowners. Consistent with theories on optimal compensation design in the presence of mobile talents, our results suggest that firms facing higher skilled labor risk use substantially more incentive pay for both top executives and employees below the top rank. Those firms also ex ante offer a higher level of pay to skilled labor. Finally, we find that firms facing higher skilled labor risk invest more in strengthening employee relations, but such investment tend to be concentrated in compensation and benefits related dimensions. Overall, our study suggests that the mobility of skilled labor is an important determinant of corporate compensation policies, affecting the split of surplus between firms' owners and employees.

Chapter 3 studies the effect of labor adjustment costs on corporate risk management. Labor adjustment costs attenuate the correlation between a firm's internal fund and its

investment opportunities and create more incentives for the firm to smooth cash flows. We find that firms in which employees are more protected by labor market institutions use more derivative contracts for risk management. We further find that firms that rely more on skilled labor engage in more derivative hedging since labor with higher skill is associated with larger adjustment costs. Such an effect is attenuated when the mobility of skilled labor is restricted.

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Chapter 1

Debt Structure as a Strategic Bargaining Tool

1.1 Introduction

Does a firm's management use debt policies to influence its bargaining position relative to employees? Although it has been theorized that increasing the debt level could strengthen management's bargaining power (Baldwin, 1983; Bronars and Deere, 1991; Perotti and Spier, 1993), empirical evidence is mixed despite the theoretical appeal. Matsa (2010) finds that the level of debt is positively correlated with firm-level union power; however, Lee and Mas (2012) and Schmalz (2015) find that the causal effect of union certification on the leverage ratio is zero on average. In this paper, we find strong causal evidence supporting the strategic bargaining view when taking debt heterogeneity into consideration.

The basic theoretical mechanism is that debt creates a commitment to make payments to creditors and hence reduces the surplus over which labor can negotiate with management without forcing firms into bankruptcy. From this point of view, what is critical is the commitment level of the debt and the credibility of the bankruptcy threats, which depend on the ease of renegotiating debt contracts. The credibility of bankruptcy threats is higher for public debt relative to bank debt because renegotiating the former is more difficult because of the existence of the Trust Indenture Act of 1939. The latter, however, can be renegotiated more easily (Gilson, John, and Lang, 1990) and is indeed frequently renegotiated before maturity (Roberts and Sufi, 2009). Within bank debt, the renegotiation likelihood also varies. It decreases with syndication size because contract renegotiation becomes more difficult with more creditors. Thus, a proper test of the theory on the strategic use of debt in managerial bargaining should take into consideration the structure of the firm's debt, not just the level of debt.

In this study, we examine both the *ex ante* adjustment of debt structure as a strategic response to an increase in employees' bargaining power and the *ex post* effect of debt structure on the outcomes of wage contract negotiations. To capture a firm's debt structure, we employ a hand-collected data set from balance sheets between 1991 and 2012 to compute the public debt to assets ratio, the bank debt to assets ratio, and the fraction of each type of debt in the firm's total amount of debt. We also use new issuance data from Securities Data Company (SDC) platinum and Loan Pricing Corporation (LPC) DealScan to measure the issuance behavior of each type of debt and the syndication structure of bank debt. To capture incremental changes in the bargaining power of labor, we use the information on labor union elections collected by the National Labor Relations Board (NLRB) and employ a regression discontinuity (RD) design to draw causal inferences. To measure the outcomes of wage negotiations, we use a special feature of the airline industry that airline firms are required by the Bureau of Transpiration to disclose detailed information on employees' wages. We have four main findings.

First, we show that debt structure is adjusted strategically as a response to an increase in employees' bargaining power. RD estimations show that while the causal impact of union certification on the corporate leverage ratio is negligible, debt structure is adjusted toward debt that is more difficult to be renegotiated after union certification. In particular, compared with firms in which unions barely lost elections (the control group), firms in which unions barely won elections (the treatment group) on average experience a 5.7-percentage-points increase in the ratio of public debt to total assets and a 5.6-percentage-points decrease in the ratio of bank debt to total assets in the following three years after elections. The effects are economically significant given that the sample average of the public debt (bank debt) to assets ratio is 21.5 percentage points (7.1 percentage points). Debt structure adjustments after union certification are further shown to be larger when elected unions are more powerful, when unions are expected to bear larger bankruptcy costs, or when a firm's employees have limited outside options.

We also find consistent evidence using new debt issuance data. Compared with firms in which unions barely lost, firms in which unions barely won are 27.2% more likely to issue at least one public debt in the following 36 months after elections, but not more likely to issue bank loans. Moreover, the fraction of the public debt issuance amount in the total new debt issuance amount also increases 21.1 percentage points after a union is certified.

Second, we find that union certification has an impact on the syndication structure of newly issued bank loans. Specifically, passing a labor union election on average leads to a 34.7% increase in the number of creditors (or 2.7 more creditors) and a 50.2% decrease in the Herfindahl-Hirschman Index (HHI) for the creditor ownership in a bank loan tranche within 36 months after elections. Such effect is shown to be not due to changes in the loan

amount after union certification. The estimations suggest that firms having little access to corporate bond markets could strategically increase the creditor dispersion of bank debt to advance the management's bargaining positions. Such evidence is complementary to the findings on the choice between public and bank debt.

Third, we perform tests to rule out alternative explanations. In particular, we first show that union certification has little effects on the changes in firm characteristics that are important for debt structure choice and mitigate the concern that debt structure adjustments after union certification are only responses to changes in other firm characteristics. Furthermore, another alternative explanation for the documented findings is that firms are more constrained from bank loan markets after union certification and have to resort to the bond market for financing. We address this concern in two ways. We first directly examine the effects of union certification on the spreads of bank loans and public debt. If the alternative explanation is the underlying driving force, then we expect to observe that the union certification effect on the bank loan spread is larger than the effect on the public debt spread and, as a result, firms are forced to finance from the corporate bond market. We find that passing an election leads to increases in both the spreads of bank loans and public debt; however, the effect of union certification on the public debt spread is not smaller than the effect on the bank loan spread. Therefore, the evidence is inconsistent with the alternative explanation.

We also further exploit the cross-sectional variation in the interest alignment between labor and management before elections. If the alternative channel drives our results, we expect the debt structure adjustments to be larger when the interests of labor unions are more aligned with managements', since labor unions then have more incentives to engage in the behavior that benefits shareholders at the cost of bank creditors and exaggerate the conflicts with banks. Using the fraction of defined contribution (DC) pension assets invested in a firm's stock to measure the interest alignment, we find that debt structure adjustments are smaller, not larger, after union certification when the interests between labor and management are more aligned before elections. Therefore, the cross-sectional evidence is inconsistent with the alternative explanation but is, however, more consistent with the strategic bargaining view because the need for strategic bargaining is reduced when the two parties have more common interests.

Finally, using data from the airline industry, we show that debt structure does affect the outcomes of wage contract negotiations. Specifically, a one-standard-deviation increase in the ratio of public debt to total assets is associated with a 5.8% decrease in annual wage per employee. Even though an increase in the leverage through bank debt does not improve the outcomes of wage contract negotiations on average, the effect of bank debt on wage concession is more significant when the average number of creditors in outstanding

loan deals is larger. Overall, the results support the point that management's bargaining position is improved when renegotiating outstanding debt is more difficult.

This paper contributes to several strands of literature. First, this paper belongs to the literature that examines the strategic role of debt policies in the bargaining relations with labor.[1] One main contribution of this paper is that we provide new evidence on how management responds to an increase in the bargaining power of non-financial stakeholders. Bronars and Deere (1991) and Matsa (2010) provide the first evidence on how management employs corporate leverage to advance bargaining position. Bronars and Deere (1991) document that the corporate leverage ratio is positively correlated with industry-level union coverage rates, and Matsa (2010) shows that corporate the leverage ratio is positively correlated with firm-level union power and varies with the adoptions and repeals of state laws that govern unions' bargaining power. However, the empirical evidence in the literature is mixed. Chen, Kacperczyk, and Ortiz-Molina (2011) do not find a positive relation between the corporate leverage ratio and union coverage rates at the industry level in their sample. Using the data on NLRB labor union elections, Lee and Mas (2012) and Schmalz (2015) further show that, on average, union certification has little impact on the corporate leverage ratio.

The literature ignores debt structure when examining the strategic role of debt policies. This paper contributes to the literature by showing the importance of debt heterogeneity, because debt structure (even after controlling for the level of total debt) affects the credibility of bankruptcy threats. Even though in this paper we focus on firms' interactions with one important non-financial stakeholder—labor unions—the conclusion can be generalized to contract negotiations with other non-financial stakeholders, as long as the bankruptcy procedure imposes larger costs on them than private workouts (e.g., lessors). Therefore, our results have broader implications beyond the labor union context.

Another contribution is that this paper provides new evidence on the impact of debt policies on *ex post* bargaining outcomes. Benmelech, Bergman, and Enriquez (2012) present evidence showing that defined benefit (DB) pension underfunding affects wage bargaining outcomes. Towner (2015) uses the U.S. hospital industry as a laboratory setting and shows that hospitals with higher leverage ratios receive higher reimbursement rates from insurance companies for a specific procedure. Using the data from the airline industry, our paper shows that the annual wage per employee is lower for airlines when renegotiating the debt in a firm's capital structure is more difficult. Our paper differentiates from Towner (2015) that we show that the effect of the leverage ratio on bargaining outcomes is driven by the

[1] This paper is also related to Klasa, Maxwell, and Ortiz-Molina (2009) which show that firms strategically hold less cash when facing stronger unions. The paper is also related to the literature that studies the interactions between product market and capital structure (Brander and Lewis, 1986; Chevalier, 1995a,b; Kovernock and Phillips, 1995; Mackay and Phillips, 2005). This paper provides evidence showing that corporate debt policies also respond to strategic incentives from labor markets.

debt structure, which decreases the ease of renegotiating debt contracts.

This paper also fits within the strand of literature that studies firms' choices of debt structure. Rauh and Sufi (2010) and Colla, Ippolito, and Li (2013) document large variations in firms' debt structures in both the cross section and the time series. On the determinants of firms' choices of debt structure, existing studies have examined information monopoly (Rajan, 1992; Houston and James, 1996), credit rating (Diamond, 1991; Denis and Mihov, 2003), corporate governance (Lin, Ma, Malatesta, and Xuan, 2013), and collateral value (Park, 2000; Lin, 2016). This paper contributes to this strand of literature by showing that management's strategic bargaining motivation also determines a firm's financing choice.

1.2 Hypothesis Development

A firm's debt structure is essential for strategic bargaining between management and employees for two reasons. First, a firm's debt structure affects the ease of out-of-court debt contract renegotiation and thus the credibility of a bankruptcy threat to employees. Theoretical literature has illustrated this point of view, and a key insight from the literature is that creditor dispersion increases debt contract renegotiation costs (Bolton and Scharfstein, 1996; Diamond, 2004; Zhong, 2014). As a result, the likelihood of out-of-court debt contract renegotiation varies across debt types. For public debt, a bankruptcy threat is more credible because it has a larger creditor dispersion and arranging successful renegotiations between issuers and holders is more difficult because of the existence of the Trust Indenture Act of 1939, which requires the bondholders' unanimity to change the interest, principal, or maturity of public debt. On the contrary, bank debt can be renegotiated more easily because of a smaller creditor dispersion, as shown in Gilson et al. (1990), and bank loans are indeed frequently renegotiated before maturities (Roberts and Sufi, 2009). Furthermore, within bank debt, the renegotiation likelihood also varies. It decreases with the syndication size of a bank loan because contract renegotiation becomes more difficult with more creditors.[2]

Second, labor unions bear larger costs under court-supervised bankruptcy than under private resolution of financial distress. Section 1113 of the Bankruptcy Code allows firms to modify or reject a collective bargaining agreement (CBA) to achieve the goal of reducing labor cost during a Chapter 11 reorganization process. Although the enactment of Section 1113 in 1984 does not allow employers to unilaterally reject a CBA without violating the National Labor Relations Act (NLRA), it has not favored labor unions in practice. In

[2]In Table 1.A1, we provide supporting evidence that an increase in creditor dispersion, measured by the number of creditors in a loan facility, is associated with a longer duration of a debt contract renegotiation. Therefore, the results suggest that debt renegotiations become more difficult when creditor dispersion increases. The data on bank loan contract renegotiations are from Roberts (2014) and are available at `http://finance.wharton.upenn.edu/~mrrobert/styled-9/styled-15/index.html`.

particular, Dawson (2010) studies the bankruptcy filings of all large public corporations between 2001 and 2007 and finds that debtors can reject CBAs in every filed 1113 motion. Recently, union executives also expressed the opinion that "workers' rights in all kinds of bankruptcy cases have been eroded," which suggests that unions' bargaining power during bankruptcy is indeed weak.[3]

The modification or rejection of CBAs outside of bankruptcy, however, is more costly for employers because of the existence of the NLRA. Once employers and employee representatives enter a CBA, it cannot be modified during the effective period, or otherwise the employers would commit unfair labor practices (Dawson, 2015).[4]

Overall, labor unions in the United States bear larger costs under court-supervised bankruptcy because of reduced bargaining power. This argument is also supported by firms' actions in reality. For example, in 2006, a U.S. bankruptcy court allowed Delta Air Lines to terminate pilots' pension plans, which led to a more than $2 billion loss of pension benefits for pilots covered by the Air Line Pilots Association (Benmelech et al., 2012). Moreover, in 2012, the management of AMR Corporation used Section 1113 of the Bankruptcy Code against American Eagle Labor Unions to obtain cost reduction concessions.[5]

Therefore, given the cost borne by non-financial stakeholders in Chapter 11, the bargaining position of a firm's management can be improved if the firm's debt is structured to include more debt that is more difficult to be renegotiated, such as public debt or bank debt with larger syndication sizes. Our main hypothesis is summarized as follows:

Hypothesis: *A firm's management adjusts debt structure toward debt that is more difficult to be renegotiated (with a larger creditor dispersion) when the employees' bargaining power increases.*

We test the hypothesis using the labor union election as a laboratory. We use the ratio of public debt to assets as one measure for creditor dispersion in capital structure. We also use the syndication size and creditor ownership concentration of newly issued bank debt as alternative measures. In particular, we examine whether management adjusts debt structure to decrease the ease of renegotiating debt contracts, such as increasing the leverage through public debt or issuing bank debt with more creditors or less concentrated creditor ownership, when there is an increase in the bargaining power of employees.

We also further provide suggestive evidence showing that debt structure indeed affects

[3]Vincent Ryan, "Labor Unions Urge Chapter 11 Reform," CFO.com, March 28, 2013, `http://ww2.cfo.com/bankruptcy/2013/03/labor-unions-urge-chapter-11-reform/`.

[4]National Labor Relations Act, 29 U.S.C. Â§ 158(a)(1), (a)(5) (2006).

[5]The same situation applies to other non-financial stakeholders such as lessors. Section 365 of the Bankruptcy Code states, "The trustee, subject to the court approval, may assume or reject any executory contract or unexpired lease of the debtor." Under this Bankruptcy Code, any rejected contract constitutes a pre-petition general unsecured claim that only pays cents on a dollar. Therefore, lessors' unexpired contracts with debtors are usually subject to rejections during bankruptcy and, as a result, lessors bear a larger cost in Chapter 11 reorganizations, compared to under out-of-court private workouts.

the bargaining outcomes between management and employees. In particular, we use the airline industry as the empirical setting and examine whether debt structure involving more debt that is not easily renegotiable improves a firm's management's bargaining position. We first use the ratio of public debt to assets to measure the difficulty of debt contract renegotiation in capital structure. Specifically, we examine whether the annual wage per employee is significantly lower for airlines with higher leverage through public debt. We then use the average number of creditors in outstanding loan deals in a given year to capture creditor dispersion within bank debt. We expect the effect of bank debt on wage concession to be more significant when the number of outstanding creditors is larger.

1.3 Data and Sample Selection

1.3.1 Debt Structure Data

Balance Sheet Data

Debt structure data come from firms' 10-K filings and span from 1991 to 2012. Because of SEC reporting regulations S-X and S-K, detailed information on firms' long-term debt issues and revolving credit facilities is available, and we hand-collect the debt structure information from the section "Notes to Financial Statement" in the 10-Ks. Based on the information from 10-Ks, we define public debt as the sum of the outstanding amount of commercial paper and bonds and notes for each fiscal year. Bank debt is defined as the sum of the outstanding amount of revolvers, term loans, and other bank loans for each fiscal year.[6]

We construct three debt structure measures. We define the "Public Debt to Assets Ratio (book or market)" as the outstanding amount of public debt on balance sheet at the fiscal year-end scaled by total assets (book or market value). We define "Bank Debt to Assets Ratio (book or market)" in a similar fashion. We also define the "% Public (Bank) Debt" as the outstanding amount of public debt (bank debt) on balance sheet at the fiscal year-end scaled by total debt.

New Issuance Data

In order to examine the impact of employees' bargaining power on debt issuance behavior, we obtain new issuance data between 1992 and 2013 from SDC platinum for corporate bonds

[6]Bonds and notes include the following debt types: public bonds, private placement, revenue bonds, medium term notes, shelf registration bonds, mortgage and equipment debt, and convertible debt. Moreover, excluding commercial paper from the public debt definition generates similar results. Because of data limitations, public debt used in this paper actually includes both publicly and privately placed debt. We cannot differentiate public bond/Rule 144-A private placement and non-Rule 144-A private placement based on the information from 10-Ks. Therefore, this is a noisy classification, but the measurement errors should bias against our results.

and the LPC DealScan database for bank loans.[7,8] One advantage of new issuance data is that we have more detailed information on the types of corporate bonds. Following Gomes and Phillips (2012), we aggregate public bond and Rule 144-A private placement into the public debt category. We therefore assign each new issuance to one of three categories: (1) public debt, (2) non-Rule 144A private placement, and (3) bank loan. Furthermore, we consider the syndication size and creditor ownership concentration of a newly issued bank loan as alternative dimensions of debt structure. We define syndication size as the number of creditors for each bank loan tranche or loan deal. For creditor ownership concentration, we follow Sufi (2007) and define it as the sum of the square of each creditor's ownership in each loan tranche.

Panel A of Table 3.1 presents the summary statistics for debt structure measures based on balance sheet and new issuance data. The balance sheet data are available from one fiscal year before to three fiscal years after each labor union election, and the new issuance data are selected to be within 36 months after each labor union election. In this sample, public debt and bank debt on average account for 68.0% and 22.9% of a firm's total debt, respectively. The summary statistics for debt issuance show that 50.1% of firms issue at least one public debt within 36 months after a labor union election. The fractions of firms issuing at least one private placement and bank loan within 36 months after each labor union election are 9.0% and 81.4% in the sample, respectively. The average number of creditors is around 8 in a bank loan tranche or a bank loan deal. The mean HHI for creditor ownership concentration is 25.9% in the sample.

1.3.2 NLRB Labor Union Election Data

The labor union election data come from two sources. Data from January 1992 to September 1999 are obtained from Thomas Holmes' website.[9] Data from October 1999 to December 2009 are obtained from the NLRB official website.[10] This data set contains employers' names, the city of election, the state of election, 3-digit SIC (January 1992-September 1999), NAICS (October 1999-December 2009), close date of the election, number of eligible voters,

[7] Another commonly used data set for new public bond issuance is Mergent FISD. In this paper, we use SDC platinum because it coverage is larger than that of Mergent FISD. It would be beneficial if we could merge SDC and FISD data to obtain more complete coverage for new debt issues of U.S. firms using the identical identifier between SDC and FISD, the international securities identification number (ISIN). Most ISINs are missing in SDC, and therefore merging these two databases becomes difficult.

[8] Murfin (2012) finds that the actual contract date is 3 months (1 month prior to receiving the mandate and 2 months for the syndication/documentation process) before the start date reported in DealScan. Therefore, we adjust the loan facility start date to be 90 days prior to the date reported in DealScan.

[9] Thomas J. Holmes, homepage for data used in "Geographic Spillover of Unionism," January 2006, `http://www.econ.umn.edu/~holmes/data/geo_spill/`. As described on the website, the data from 1977-1992 are from Henry Farber and Bruce Fallick; data from 1993-1994 are from National Archives, and data from 1995-1999 are from NLRB.

[10] National Labor Relations Board, `http://www.nlrb.gov/opengov/nlrb-data-data.gov`.

petition type, and total votes for and against an election. There are three types of petitions: representation petitions in which employees seek to be represented by unions or unions seek to be certified, decertification petitions in which employees seek to remove existing unions, and employer-filed petitions in which employers seek to remove existing unions. We focus on the first type, which ensures that the employees in the bargaining unit were not unionized before.[11] Following Lee and Mas (2012), we keep elections in which the number of eligible voters is greater than or equal to 100. Following DiNardo and Lee (2004), we standardize the vote shares to the support for elections in which the minimum vote cast is 100.[12] Specifically, we assign the vote share of 50.5% to all vote shares between 50% and 51% and assign the vote share of 49.5% to all vote shares between 49% and 50% and so forth. We also use the tally-based margin of union victory as an alternative specification for the running variable. It is defined as the difference between the number of votes for unions and the number of votes needed for union victory. Throughout the paper, we report results using the vote share for unions as the running variable. The main results using the tally-based running variable are available in Table 1.A4.

We merge labor union election data with debt structure data by firm names. The final sample in this paper spans from 1992 to 2009 and includes 851 elections involving 427 unique firms.[13] Panel B of Table 3.1 reports the summary statistics for labor union election data. The average vote share is 42.3%, which is below the 50% share with which a union wins by a simple majority rule. On average, the unions win 28.1% of all elections in our sample, consistent with the statistics of the vote share. Panel C presents the distribution of the number of elections and the passage rate of elections by industry (one-digit SIC code). As expected, elections in manufacturing industries account for more than 67% of all elections in the sample. The year distribution of the number of elections in the sample is presented in Figure 1.1 and shows that the elections in the sample concentrate in the years between 1994 and 2006.

[11] After merging with debt structure data, the number of observations for decertification and employer-filed petitions are too few to conduct a formal analysis.

[12] We do this is to restore the symmetry between small and large elections; otherwise, we mechanically put more weights on large elections when we focus on close elections. Our results are robust without such manipulation.

[13] The details for data assembly are available in Appendix A.3.

1.4 Employees' Bargaining Power and Debt Structure Adjustment: Empirical Strategy

1.4.1 Identification Strategy

In order to test the hypothesis, we use labor union elections overseen by the NLRB as a laboratory setting and employ an RD design to estimate how debt structure is adjusted when employees' bargaining power increases. The exogenous variation in employees' bargaining power that we exploit comes from the rule that determines the winning status of labor union elections. By law, a union wins the election by a simple majority rule (i.e., strictly larger than 50% of total valid votes that are in favor of unionization). A union is certified as the collective bargaining agent in the establishment as a consequence of a secret ballot election won by the union. Consequently, employees' bargaining power in the establishment increases discontinuously once vote shares for unions pass 50% (DiNardo and Lee, 2004). In the following subsections, we first implement tests to show that the identification assumption for an RD design is satisfied and then discuss the estimation method.

1.4.2 Validity Tests

The key identification assumption for an RD design is that the conditional distribution of potential outcomes as a function of vote share is continuous around the winning threshold (local continuity assumption). Under this assumption, the treatment of union certification is "as good as random" for close elections , and therefore any observed post-election difference in debt structure distribution between firms in which unions barely won elections and firms in which unions barely lost elections is due to the treatment effect of union certification. Even though the assumption is not directly testable, Lee (2008) has shown that the assumption would be likely to be satisfied if vote shares are not *perfectly* manipulated by voters around the 50% cutoff. Therefore, the tests of the discontinuities in the distribution of vote shares and predetermined firm characteristics before elections can provide evidence for or against the assumption. Any detected discontinuity would cast doubt on the validity of RD estimations.

Vote Share Density

We use the procedures developed in McCrary (2008) and Frandsen (2016) to test the discontinuities in the vote share distribution. The results of the vote share density test in McCrary (2008) are presented in Figure 3.1. The x-axis is the vote share for unions, and the solid line is the fitted density with a 95% confidence interval around it. The discontinuity estimate is -0.028, and the corresponding standard error is 0.173. Therefore, we cannot reject the

hypothesis that there is no perfect manipulation of vote shares around the cutoff at the conventional 5% level. We further use the procedure developed in Frandsen (2016), which points out that McCrary's test is not suitable for discrete running variables, to perform a second test for the discontinuity in vote share density since the binned vote shares are discrete. By applying this newly developed method, we still cannot reject the null hypothesis that there is no perfect manipulation around the winning threshold with a p-value equal to 0.770. Overall, the results of McCrary's and Frandsen's tests together suggest that the vote share is unlikely to be perfectly manipulated in our sample.

Even though Frandsen (2015) finds evidence showing that vote shares for unions are perfectly manipulated around the 50% threshold for elections with at least 20, 40, 60, or 80 votes, the McCrary test cannot reject the null hypothesis that there is no perfect manipulation of vote shares around the winning threshold when the number of votes is restricted to be at least 100 in Frandsen (2015). Such evidence is consistent with the results in our paper that we cannot statistically detect the perfect manipulation of the vote shares around the 50% cutoff when we restrict the number of eligible voters in elections to be at least 100.

Continuities in Predetermined Firm Characteristics

The evidence in Frandsen (2015), however, raises the concern that vote shares could be perfectly manipulated by unions or management in reality and this would threaten the RD identification assumption. In order to mitigate this concern, we further examine the continuities in the level of predetermined firm characteristics and check whether the results are consistent with the validity of the RD identification assumption.

If the vote shares are not perfectly manipulated by voters, then there should be little difference in both observable and unobservable predetermined firm characteristics between firms in which unions are barely certified (treatment group firms) and those in which unions are barely not certified (control group firms) within the narrow band of the 50% cutoff (Lee, 2008). Even though such a statement for unobservable firm characteristics is not testable, the balance in observable covariates between treatment and control groups is testable. We define the predetermined firm characteristics as the ones that are one fiscal year before the election close years and provide empirical evidence showing that within the vicinity of the 50% cutoff, predetermined observable firm characteristics are comparable between treated and control firms.

In particular, to test the null hypothesis that union certification has little impact on predetermined characteristics, we implement an RD estimation with a rectangular kernel and the optimal bandwidth developed in Imbens and Kalyanaraman (2012) for each predetermined firm characteristic, including debt structure measures, firm size, book and market

leverage, market-to-book ratio, tangibility, ROA, modified Z-score, and cash holding. All RD estimations include vote shares allowing for different slopes on each side of the cutoff. Standard errors are robust and clustered at the firm level.

Table 1.2 presents the results and shows that all estimations are small and statistically insignificant. Therefore, the results suggest that there is little difference in the predetermined characteristics between firms in the treatment and control groups. Overall, the results in Figure 3.1 and Table 1.2 together imply that the identification assumption is unlikely to be violated in our sample.

Further Discussions

In this paper, the identification of the union certification effects depends on a weaker identification assumption than the local continuity assumption since we are interested in estimating the effects of union certification on the *adjustment* of debt structure. This weaker identification assumption requires the panel natural of the data and is proposed in Frandsen (2015) in the presence of discontinuities in the pre-election characteristics (Assumption A1' in Frandsen (2015)). This weaker identification assumption states that the conditional distribution of the first difference in the potential outcomes as a function of vote share for unions is continuous around the threshold. Under this assumption, the union certification effect is identified by comparing the post-election change in the outcome variables.

We test this weaker assumption in Table 1.A2 and show that statistically there are no discontinuities in the first difference in the predetermined variables from t-2 to t-1 between firms in which unions barely won and unions barely lost the elections. We cannot reject the joint hypothesis that the effects of union certification for all predetermined firm characteristics equal zero with a p-value equal to 0.922. Therefore, this weaker identification assumption is more likely satisfied in our sample and our results are robust even if the local continuity assumption for an RD estimation is violated.

Regarding the manipulations of vote shares, one may be still concerned that in elections with small margins of victory (MOV), the losing party would have great incentives to challenge the ballots in order to change the election outcomes. As a result, the observed vote counts for unions in the data are more likely to be manipulated when MOV is smaller (Frandsen, 2015). If the economic object of interest in close elections is MOV instead of the vote shares for unions, then we need to further test whether MOV is perfectly manipulated by unions or management. Since the tally-based running variable is discrete, we use the test proposed in Frandsen (2016). The results show that we still cannot reject the null hypothesis that there is no perfect manipulation of the vote counts around the winning threshold with a p-value equal to 0.184. Therefore, this evidence suggests that the RD identification

assumption is more likely to be satisfied in our sample. To further mitigate the concern, we also present evidence in the robustness tests and show that our results will be robust if we exclude the elections with small MOV.

1.4.3 Estimation Method

An RD design can be implemented in two ways: by global polynomial regressions and by local polynomial regressions.[14] For a global polynomial regression, we use all available data and control polynomials in vote shares to achieve the identification. In a local polynomial regression, we estimate the causal effect by choosing appropriate kernel functions and bandwidths and controlling linear or quadratic terms in vote shares. Following the suggestions in Gelman and Imbens (2014), we use local linear regressions instead of global polynomial regressions throughout all analysis.[15] Specifically, we estimate the following specification with a weighting scheme ω_i within a chosen bandwidth h:

$$Y_i - Y_{i,-1} = \alpha + \beta_1 WIN_i + \beta_2 WIN_i \times (R_i - 0.5) + \beta_3 (R_i - 0.5) + \epsilon_i \quad (1.1)$$

with weights $\omega_i = K(\frac{R_i - 0.5}{h})$, where K($\bullet$) is a kernel function. K($\bullet$) could be either rectangular (OLS estimation) or triangular kernel (WLS estimation). WIN_i represents the winning status dummy for election i, and R_i represents vote shares for the union in election i. Y_i is the three-year average of each debt structure measure after election i. $Y_{i,-1}$ presents each debt structure measure one fiscal year before election i. Estimated β_1 represents the treatment effect of union certification. In all regressions, we treat the elections within the same firm in different years independently and cluster standard errors at the firm level to account for the correlations within the same firm. For main results, we use the optimal bandwidth choice in Imbens and Kalyanaraman (2012) (IK-optimal). In the robustness checks section, we also use alternative choices of bandwidths and specifications to ensure the robustness of our results.

[14] Please see Lee and Lemieux (2010) for a comprehensive discussion of these two estimation methods

[15] Gelman and Imbens (2014) argue three drawbacks of global polynomial regressions. The first issue is that the implicit weights on observations far away from cutoffs are noisy. The second issue is that the estimated treatment effect is sensitive to the choice of polynomial order, and the final issue is that the confidence interval obtained from global polynomial regressions is too narrow. Our results are also robust if we use the polynomial regressions and the results are in Table 1.A3.

1.5 Employees' Bargaining Power and Debt Structure Adjustment: Main Results

1.5.1 Labor Unionization and Debt Structure: OLS Evidence

In this subsection, we present the OLS evidence on how employees' bargaining power affects debt structure, and we use a firm's unionization status as a proxy for the bargaining power of employees in the firm. The firm-level data on labor unionization come from two sources. We first construct the unionization dummy from corporate 10-K filings and then cross-check and augment the measure with the data from IRS 5500 form.[16] Debt structure data are from S&P Capital IQ and a hand-collected data set from balance sheets. Table 1.3 presents the effect of labor unionization on the corporate leverage ratio, the ratio of public debt to total assets, and the ratio of bank debt to total assets.[17] In all regressions, we include firm-level controls including firm size (Ln(AT)), ROA, market-to-book ratio (MTB), tangibility, modified Z-score, and dividend payer dummy. SIC2 $\times$ Year fixed effects are also included in all regressions. Robust standard errors are clustered at the firm level. Since the time-series variation in the unionization dummy is small, the main variation comes from the cross-firm variation within the same 2-digit SIC industry in the same year. The estimation in column (1) shows that compared with non-unionized firms in the same 2-digit SIC industry in the same year, unionized firms have higher corporate leverage ratios, and such evidence is consistent with the results in Bronars and Deere (1991) and Matsa (2010). The two studies, however, ignore the debt heterogeneities within capital structure. In contrast, our paper takes debt structure into consideration and present the results in columns (2) and (3). The estimations further show that compared with non-unionized firms, unionized firms have a higher leverage through public debt, whereas the difference in the leverage through bank debt between unionized and non-unionized firms is small and insignificant. The cross-sectional evidence therefore suggests that the effect of unionization on the corporate leverage ratio is driven by the effect on the leverage through public debt rather than bank debt. Although the OLS estimations are consistent with the hypothesis that a firm's management tends to increase the amount of debt that is difficult to be renegotiated when employees' bargaining power is higher, the estimations cannot be interpreted as causal. In the following, we present

[16] To construct the unionization dummy measure, we develop Perl scripts to extract the data from 10-K filings. The IRS 5500 data from 1990 to 2007 are available from the Center for Retirement Research at Boston College at `http://crr.bc.edu/data/form-5500-annual-reports/`. The data from 2008 to 2013 are available from the Department of Labor at `https://www.dol.gov/ebsa/5500main.html`.

[17] Ideally, we should examine the effect of labor unionization on the ratio of debt that is difficult to be renegotiated to total assets. In theory, the amount of bank debt with a large syndication size should also increase when labor's bargaining power is higher. However, the data collection on the number of creditors and amount of outstanding bank debt on the balance sheet is difficult; therefore, we focus on the choice between public and bank debt in this subsection.

causal evidence on the relation between employees' bargaining power and debt structure using the information on NLRB labor union elections.

1.5.2 Union Certification and Debt Structure Adjustment: RD Evidence

This subsection presents RD evidence showing that it is debt structure, not the debt level, that is adjusted strategically as a response to new legal recognition of unions. As a start, we initially confirm the results in the literature that firms' management does not strategically adjust the corporate leverage ratio as a response to an increase in employees' bargaining power. We first present the graphical analysis and then report the regression-based results. In Figure 1.3, we plot the empirical expected value of the corporate leverage ratio adjustment condition on vote shares and check whether there is any significant discontinuity around the 50% cutoff.

In each plot, the x-axis represents the vote share for unions, and we use the optimal bandwidths employed in the estimations in the plots. Each dot represents the average corporate leverage ratio adjustment in a 2% bin, and the dots are fitted using a linear line on each side of the 50% cutoff, with the shaded area being the 95% confidence interval. The upper and lower plots represent the adjustment of book and market leverage ratios, respectively. In both plots, we do not observe significant discontinuities around 50% cutoff and the results suggest that union certification has little effect on the corporate leverage ratio adjustments.

We further estimate the treatment effect of union certification on corporate leverage ratio adjustments using local linear estimations with different choices of bandwidths and rectangular kernels. The estimations in Table 1.4 are economically small and statistically insignificant and confirm the visual effects in Figure 1.3. These results are consistent with the findings in Lee and Mas (2012) and Schmalz (2015).

Next, we present results showing that firms' management actively adjusts debt structure, instead of debt level, as a response to union certification. In Figure 3.2, we plot the empirical expected value of the debt structure adjustment condition on vote shares using the optimal bandwidths in the estimations and check whether there is any significant discontinuity around the 50% cutoff. In each plot, a dot represents the average debt structure adjustment in a 2% bin, with the shaded area in each plot being the 95% confidence interval. The plots on the left- and right-hand sides represent the adjustments of debt structure measures for public and bank debt, respectively. In all plots, we observe significant discontinuities around the 50% cutoff, and this is the first sign of a causal effect of union certification on debt structure adjustments.

Table 1.5 presents the RD estimations. Panels A and B present results using rectangular

and triangular kernels in estimations, respectively, and we use the IK-optimal bandwidths in all regressions. For each type of debt, we present results using three different measures as the dependent variables in regressions.

The results show that firms in which unions barely won elections significantly increase leverage through public debt and decrease leverage through bank debt, compared with a set of otherwise similar firms in which unions barely lost elections. Specifically, based on the results in Panel A, passing a labor union election leads to a 5.7-percentage-points increase in the ratio of public debt to total assets and a 5.6-percentage-points decrease in the ratio of bank debt to total assets. These results are not only statistically significant but also economically large given that the sample mean of book leverage through public and bank debt is 21.5 percentage points and 7.1 percentage points, respectively. Overall, the results suggest that a firm's management adjusts debt structure to decrease the ease of renegotiating debt contracts when employees' bargaining power increases.

1.5.3 Evidence from New Debt Issuance Data

One drawback of the balance sheet data is that they do not differentiate public bond/Rule 144-A private placement from non-Rule 144-A private placement within the defined public debt. In this section, we use data at the new issuance level and present further evidence.

In particular, we use data from SDC and DealScan and estimate the causal impact of union certification on new issuance of public debt (public bond and Rule 144-A private placement), non-Rule 144-A private placement, and bank debt within 36 months after elections. Table 1.6 presents the results. The first three columns present results for issuance probability, and the last three columns present results for the fraction of each type of debt's new issuance amount in total new issuance amount.

The estimations suggest that firms in which unions barely won are 27.2% more likely to issue at least one public debt in the following 36 months, compared with firms in which unions barely lost. The impact of union certification on the issuance probability of non-Rule 144-A private placement is negative and significant, and the effect on the issuance probability of bank loans is insignificant. Moreover, the results also show that closely won elections lead to an increase of 21.1 percentage points (the sample mean is 37.57 percentage points) in the fraction of public debt amount in total new issuance amount in the following 36 months. The effect on the fraction for non-Rule 144-A private placement or bank loan is negative and insignificant. Overall, the results in Table 1.6 provide further evidence showing that firms' management strategically issues more debt that is more difficult to be renegotiated to advance bargaining positions after union certification.

1.5.4 Cross-Sectional Analysis

In this subsection, we exploit the cross-sectional variations in the bargaining power of elected unions, the bankruptcy costs expected to be borne by unions, and employees' outside options to further strengthen the identification of the effect of union certification on a firm's debt structure adjustments.

Right-to-Work Law Analysis

The RTW law is legislation that prevents union shops. In states with RTW laws, employees in workplaces with CBAs are not required to pay union dues even though they can receive the benefits of collective bargaining. Such a law therefore creates free-rider problems for unions, which makes joining them less economically attractive to workers. The combination of reduced financial support and workers' unwillingness to join unions diminishes unions' ability to organize strikes (Ellwood and Glenn, 1987). This effect has important implications for unions' bargaining position relative to employers, since the ability to organize strikes grants unions much bargaining power. If unions' bargaining power is reduced in states with RTW laws, we expect the effect of union certification to be stronger (weaker) for elections held in states without (with) RTW laws.

Since firms' management bargains with unions in each plant, we split the sample into RTW and non-RTW elections based on election states.[18] The results are reported in Panels A and B of Table 3.4. The estimations show that debt structure adjustments are large and significant for elections held in non-RTW states (Panel A), but are much smaller and insignificant for elections held in RTW states (Panel B). Specifically, based on the results in the first column in each panel, passing a labor union election leads to a 6.7-percentage-points increase in the ratio of public debt to total assets for elections held in non-RTW states, and only 0.3 percentage points for elections held in RTW states.

Union Election Size Analysis

Alternatively, we use election size as another proxy for union power. An elected union has greater bargaining power if it represents a larger fraction of employees in a firm. We measure election size as the fraction of an election's eligible voters in a firm's total employment. Specifically, we define large (small) elections as those that rank in the top (bottom) half in the sample distribution of election size. The average election size is 7.68% for large elections and 0.45% for small elections. Therefore, we have meaningful variations in the election

[18]The states that have passed RTW laws as of 2009 are: Alabama, Arizona, Arkansas, Florida, Georgia, Idaho, Iowa, Kansas, Louisiana, Mississippi, Nebraska, Nevada, North Carolina, North Dakota, Oklahoma (after 2001), South Carolina, South Dakota, Tennessee, Texas (after 1993), Utah, Virginia, and Wyoming. Moreover, the RTW law in Indiana and Michigan became effective in 2012 and 2013, respectively.

size across these two groups. We examine whether the effect of union certification on debt structure adjustment is stronger for larger elections. Panels C and D of Table 3.4 present the results.

The estimations show that the effect of union certification on debt structure adjustment is large and significant only for large elections, and is small and insignificant for small elections. Specifically, based on the results in the first column in each panel, passing a labor union election leads to a 6.3-percentage-points increase in the ratio of public debt to total assets for large elections, and only 2.6 percentage points for small elections.

Unions' Bankruptcy Costs Analysis

We further investigate whether our estimations vary with the costs expected to be borne by labor unions during the bankruptcy procedure. If the debt structure adjustment is strategic, then the effect should concentrate on firms in which employers' bankruptcies are expected to be costly for unions, since debt structure only becomes an effective bargaining tool in these firms. To capture unions' bankruptcy costs, we use a firm's predetermined underfunding status of DB pension plans. The use of this measure as a proxy for costs borne by labor during Chapter 11 reorganization can be justified by the evidence in Benmelech et al. (2012), which demonstrate that the threat of bankruptcy is more acute for labor if the deficits of DB pension plans are larger.

DB pension plan data come from Compustat Pension Annual Database. The deficit of a firm's DB pension plans is defined as the difference between the projected benefit obligations and the fair value of pension plan assets. Table 1.8 presents the results. The estimation in the first column in Panel A shows that passing a labor union election leads to a 12.1-percentage-points increase in the ratio of public debt to total assets when unions are expected to bear larger bankruptcy costs; however, the estimation is negative 1.6 percentage points for firms in which DB pension plans are not underfunded, as shown in the first column in Panel B.

Employees' Outside Options Analysis

In this test, we examine the effect of union certification on debt structure adjustments conditional on the outside options of employees in a firm. If employees have more outside options, then the credibility of bankruptcy threats to employees should become weaker and this would lead to a reduced effect of union certification on debt structure adjustments. To capture employees' outside options in a firm, we use the number of local rivals, specifically the number of rivals in the 2-digit SIC industry within a 50-mile radius around a firm's headquarters, as a proxy. In particular, employees are defined to have more (fewer) outside

options if the number of local rivals is above (below) the sample median. Table 1.9 presents the results. The estimation in the first column in Panel A shows that passing a labor union election leads to a 7.4-percentage-points increase in the ratio of public debt to total assets when employees have fewer outside options; however, the estimation is only 3.2-percentage-points for firms in which employees have limited outside options, as shown in the first column in Panel B.

Overall, the results in Table 3.4, Table 1.8, and Table 1.9 suggest that debt structure adjustment after union certification is stronger when unions are more powerful, when unions are expected to bear larger costs during Chapter 11 reorganization, or when a firm's employees have limited outside options. The cross sectional evidence further strengthens the interpretation of the RD estimations in Table 1.5.

1.5.5 Robustness Checks and Placebo Tests

Robustness Checks

We provide robustness checks for the main results in Table 1.5 in this subsection. The robustness checks include: (1) using alternative bandwidths in estimations, (2) inclusion of predetermined firm characteristics, and (3) using alternative sample selections for labor union elections. The results are presented in Table 1.10.

In Panels A and B, we use alternative bandwidths of 5% and 10% instead of the IK-optimal bandwidths used in Table 1.5. The estimations are based on local linear regressions with rectangular kernels. The results show that the main results are robust to alternative choices of bandwidths. In order to further assess the sensitivities of estimations to various bandwidths, we plot the local linear estimations with rectangular kernels against bandwidths from 0.01 to 0.5 in Figure 1.5. The plots on the left- and right-hand sides represent the results for public and bank debt, respectively. In each plot, the solid line represents the local linear estimations and dotted lines represent the 95% confidence intervals. The vertical line in each plot represents the estimated results with optimal bandwidths in Imbens and Kalyanaraman (2012). Figure 1.5 shows that the estimations are stable across the chosen bandwidths, suggesting that the local linear estimations are robust to alternative choices of bandwidths.

In Panel C of Table 1.10, we include predetermined firm characteristics including firm size, book leverage, ROA, tangibility, market-to-book ratio, and modified Z-score, in RD estimations. The estimations show that including predetermined firm characteristics barely changes our main results. This fact also ensures the validity of our main RD estimations because it suggests that the predetermined firm characteristics are independent of the treatment status within the vicinity of the 50% cutoff.

In Panels D and E, we present estimations for alternative sample selections for labor

union elections. In Panel D, we keep the first election in each firm-year observation, and we use all elections in Panel E. The estimations show that our main results are robust to alternative sample constructions. Overall, the results in Table 1.10 indicate that our main results are robust to alternative choices of bandwidths and the inclusion of predetermined firm characteristics, and are not driven by a particular method of sample selection.

In order to further mitigate the concern that the incentives for vote share manipulations are greater when MOV is smaller, we also use the dobut-RD approach (Barreca, Guldi, Lindo, and Waddell, 2011). The dobut-RD specification excludes the elections with small MOV and examine whether results are robust to this alternative specification. In Panel F, we use the same bandwidths in Table 1.5 and exclude elections in which the outcomes would have been changed by one vote count. The results show that our results are robust to the exclusions of the elections that are most likely to be subject to the manipulations by voters and reassure the validity of our estimations.

Overall, the results in Table 1.10 indicate that our main results are robust to alternative choices of bandwidths and the inclusion of predetermined firm characteristics, are not driven by a particular method of sample selection, and are robust to the donut-RD approach.

Placebo Tests

We also implement a placebo test to rule out the possibility that the causal relation between union certification and debt structure adjustment is spurious. In particular, we investigate whether the impact of union certification on debt structure documented in Table 1.5 disappears if we arbitrarily choose a winning threshold other than 50%. In particular, we randomly choose a number between 0.3 and 0.7 as the artificial threshold each time and then estimate how debt structure is adjusted as a response to the pseudo union certification using a local linear estimation. This exercise is repeated 5,000 times, and the histograms of the estimations are reported in Figure 1.6. The vertical lines represent the estimations presented in Table 1.5 in which the winning threshold is 50%. Figure 1.6 shows that all histograms are centered around 0 and therefore suggests that any impact of union certification on debt structure adjustment disappears if an artificially winning threshold is chosen. This placebo test further strengths the causal relation documented in the previous analysis.

1.5.6 Syndication Structure of Bank Loans

One limitation of the analysis in Table 1.5 is that firms having little access to corporate bond markets are excluded from the sample. In this section, we consider another dimension of debt structure—syndication structure of bank loans—and show that firms can issue loans with a larger creditor dispersion as a response to an increase in employees' bargaining power

even if they are constrained from corporate bond markets.

To test this idea, we restrict the estimation window to be 36 months after each election and use two measures for the syndication structure of newly issued bank loans. The first one is the natural logarithm of post-election average syndication size, and the second one is the natural logarithm of post-election average creditor ownership concentration.[19] In order to mitigate the concern that changes in syndication structure could be due to changes in loan amount, we also estimate the effect of union certification on average loan amount in the following 36 months after elections. All results are estimated using local linear regressions with the optimal bandwidth and rectangular kernels. Standard errors are robust and clustered at the firm level.

Table 1.11 presents the results. Columns (1) and (2) present results for syndication size defined at the loan tranche level and the loan deal level, respectively. Column (3) presents the result for creditor ownership concentration and column (4) presents the result for loan amount. We find that syndication size of bank debt increases and creditor ownership becomes more dispersed after union certification. In particular, the estimation in column (1) suggests that compared with firms in which unions barely lost elections, syndication size of new bank loans increases by 34.7% (or 2.7 more creditors) for firms in which unions barely won elections. The result in column (3) shows that the HHI for creditor ownership of new bank loans decreases by 50.2% once a labor union election is passed. Finally, the estimation in column (4) shows that union certification has little effect on the amount of loan issuance, and the concern that changes in syndication structure are due to changes in loan amount is mitigated. Overall, the results in Table 1.11 are consistent with the mechanism such that firms strategically structure debt to make debt contract renegotiation more difficult when employees' bargaining power increases and therefore are complementary to the results in Table 1.5.[20]

1.6 Employees' Bargaining Power and Debt Structure Adjustment: Alternative Explanations

In this section, we perform tests to rule out alternative explanations for the documented results. Even though our results are consistent with the strategic view of debt structure,

[19] We exclude the following loans from the sample: (1) tranches that are not syndicated in the United States, (2) tranches that are not denominated in U.S. dollars, (3) the 364-day facility or loan primary purpose is for working capital, and (4) any loan with maturity less than or equal to one year. The short-term loans are usually treated as part of working capital instead of capital structure.

[20] We also test whether union certification has any effect on the syndication structure of bank loans issued within 12 months before elections. The results show that union certification has little effect and suggest that there is little difference in the pre-election level of syndication structure between treatment and control groups.

other channels could generate the same empirical results. One concern is that after union certification, other firm characteristics may change and debt structure adjustments are only responses to these changes. In Section 6.1, we present evidence to mitigate such concern. Another explanation is that after union certification, firms are more constrained from bank loan markets and, as a consequence, firms have to resort to the corporate bond market for financing. The adjustment of debt structure after union certification could be due to this supply side effect rather than management's strategic demand. To show that our results are not driven by this alternative channel, we provide two pieces of evidence in Sections 6.2 and 6.3.

1.6.1 Does Union Certification Affect Other Firm Characteristics?

In this subsection, we present evidence to mitigate the concern that debt structure adjustments are only responses to changes in other firm characteristics after union certification. In particular, we examine the effects of union certification on the changes in other firm characteristics that are important for the choice of debt structure in the sample, including asset tangibility, R&D investment, capital investment, profitability, productivity, Zscore, credit rating, and bid-ask spread. A change in a firm characteristic is defined as the difference between the average value in the following three years after an election and the value one year before the election. Table 1.12 presents the results. Panels A and B present results using rectangular and triangular kernels in estimations, respectively, and we use the IK-optimal bandwidths in all regressions. The estimations show that union certification has little effects on these characteristics and suggest that debt structure adjustments after union certification are not responses to changes in asset tangibility, corporate investment, firm performance, corporate risk, or information asymmetry.

1.6.2 The Pricing Effects of Union Certification on Bank Loans and Public Debt

In this subsection, we directly examine the effects of union certification on the spreads of bank loans and public corporate debt, which includes both public bond and Rule 144-A private placement. If the alternative explanation drives our results, we expect the spread of public debt to be less than the spread of bank loans after union certification. Otherwise, it is unlikely that firms resort to the public debt market for financing because of higher spreads charged by banks after union certification. Corporate public debt yield is from the Mergent FISD database, and the Treasury bond yield is from the FRED database available through the Federal Reserve Bank at St. Louis. The spread of public debt is calculated as the difference between the public debt yield and the maturity-matched Treasury yield.

When the maturity of Treasury bonds is not exactly matched to that of corporate public debt, we estimate the Treasury bond yield using a linear interpolation.

In particular, we estimate the effects of union certification on the spreads of bank loans and public debt in the following 24, 36, 48, and 60 months after elections in the sample used in Table 1.5. Since the cost of debt is also correlated with other debt-level characteristics, all regressions are estimated at the debt-level and control debt-level characteristics. We also include the pre-election average of the public debt or bank debt spread to increase the estimation precision. Standard errors are robust and clustered at the firm level.

Table 1.13 presents the results. The estimations show that even though the spreads of both bank loans and public debt both increase after union certification, the effect of union certification on the bank loan spread is not significantly larger than the effect on the public debt spread. In particular, the results show that in the following 24 months after the elections, the loan spread increases 75.08 basis points while the public debt spread increases 93.18 basis points after union certification. For other estimation windows, the difference between the two estimation coefficients on WIN is not statistically significant either. Therefore, such results mitigate the concern that firms issue more public debt after union certification simply because firms can do so more easily.

1.6.3 Does Interest Alignment between Labor and Management Matter?

In this subsection, we provide further evidence showing that our results are unlikely driven by the proposed alternative explanation. If our results are driven by the reason that banks charge higher spreads after union certification because of the conflicts between banks and labor unions, we expect such conflicts to be exaggerated when the interests between labor and management are more aligned, since unions then have more incentives to engage in the behavior, such as underinvestment, that benefits shareholders but hurts bank creditors. As a result, the substitution effect between bank loans and public debt should be stronger after union certification. However, if management adjusts debt structure to advance the bargaining position relative to employees, we expect the adjustment to be mitigated if the interest alignment between labor and management is stronger because the need for strategic bargaining is reduced when the two parties have more common interests.

Following Rauh (2006), we use two measures as proxies for the interest alignment between labor and management. The first measure is the fraction of DC pension assets invested in a firm's stock, and the second measure is the fraction of a firm's equity value held by employees through DC pension assets (DC pension ownership). The data on fair value and detailed asset holdings of DC pension plans come from IRS Form 5500 through the Center

for Retirement Research at Boston College.[21]

Table 1.14 presents the results. Panels A and B present results for firms with smaller and larger fractions of DC pension assets invested in a firm's stock, respectively. Panels C and D present results for firms with smaller and larger DC pension ownership, respectively. In particular, based on the result in the first column in Panel A, passing a labor union election leads to a 7.8-percentage-points increase in the ratio of public debt to total assets when the interest between labor and management is more divergent; however, the estimation is negative 0.6 percentage points for firms in which the interest between labor and management is more aligned. Panels C and D present similar results.

Overall, the results in Table 1.14 show that debt structure adjustment after union certification is smaller, not larger, when the interests between labor and management are more aligned. Such evidence is inconsistent with the alternative channel but is more consistent with the view that debt structure is adjusted strategically to improve management's bargaining position against labor unions.

1.7 Debt Structure and Wage Contracts: Airline Industry Evidence

In this section, we present suggestive evidence showing that debt structure that decreases the ease of renegotiating debt contracts effectively advances management's bargaining positions during wage contract negotiations with employees. We focus on the airline industry because airlines with annual operating revenue greater than $20 million are required to disclose detailed information about employees' salaries to the Bureau of Transportation each quarter, and this disclosure requirement enables empirical tests.

The employee wage data for airlines come from the Form 41 database available through the Bureau of Transportation and spans from 1990 to 2013. The annual wage per employee data are constructed from Schedules P-6 and P-10 in the database. Schedule P-6 reports quarterly operating expenses for airlines with annual operating revenue larger than $20 million and contains detailed wage information for different categories of jobs.[22] Since we are interested in the negotiations between management and rank-and-file employees, we exclude the data in the job category of general management personnel and calculate the annual total salaries for each airline by aggregating the quarterly salaries. Schedule P-10 reports the annual total number of employees, and for each airline-year observation, we

[21] The data from Center for Retirement Research at Boston College are available at `http://crr.bc.edu/data/form-5500-annual-reports/` and are available between 1990 and 2007. We exclude plan-year observations such that part or all of the assets are in common or master trusts, following Rauh (2006).

[22] The categories of jobs include: (1) general management personnel, (2) flight personnel, (3) maintenance labor, (4) aircraft and traffic handling personnel, and (5) other personnel.

compute the annual wage per employee as total salaries divided by total employment.[23] Since we are interested in the bankruptcy *threat* effects of debt structure on wage contract designs, the firm-year observations that are in Chapter 11 procedures are therefore excluded from the sample. The data on the dates of bankruptcy filing and reorganization are from Thomas Reuters SDC Corporate Restructurings Database.[24]

The financial data for airlines are from Schedules B-1 and P-1.2 in the Form 41 database. Following Benmelech et al. (2012), we define profitability as earnings divided by total assets. To gather data on the market-to-book ratio, we merge the airline data with Compustat using corporate names and each matched airline-year observation is assigned a GVKEY as the identifier.[25] Finally, we merge the airline data with debt structure data that is hand collected from 10-Ks using GVKEY. This matching procedure ultimately yields 25 airlines with a total of 250 observations spanning from 1992 to 2013.[26]

We use the average wage per employee as a proxy for wage bargaining outcome and estimate Equation (3.3) to test whether the average wage per employee is lower when renegotiating debt is more difficult:

$$Log(Wages/Employee_{i,t}) = \alpha + \beta Renegotiability_{i,t} + \gamma Z_{i,t} + \delta f_i + \theta d_t + \xi_{i,t} \qquad (1.2)$$

$Log(Wages/Employee_{i,t})$ is the natural logarithm of average wage per employee for airline i in year t. $Renegotiability_{i,t}$ represents the ease of debt renegotiation for airline i in year t. The vector $Z_{i,t}$ includes firm size, profitability, market-to-book ratio, tangibility, and negative earning dummy. Vectors f_i and d_t include airline and year fixed effects.[27]

$Renegotiability_{i,t}$ is measured by one of the following measures: the ratio of public debt to total assets (Public/AT), the ratio of bank debt to total assets (Bank/AT), and the interaction between the ratio of bank debt to total assets and the average number of creditors in outstanding loan deals (Bank/AT$\times$ # Creditor). β is the coefficient of interest. A

[23] Our results barely change if we include the data in the job category of general management personnel.

[24] In our sample, the firm-year observations in which airlines filed Chapter 11 are: Allegiant Air (2000-2001), American Airlines Inc. (2011-2013), Atlas Air Inc. (2004), Continental Airlines (1990-1993), Delta Airlines (2005-2007), Frontier Airlines (2008-2009), Hawaiian Airlines (2003-2005), Kitty Hawk Aircargo and Kitty Hawk International (2000-2002), Mesa Airlines (2010-2011), Northwest Airlines (2005-2007), Tower Air Inc. (since 2000), Trans World Airways (1992-1993 and 1995), United Airlines (2002-2006), US Airways (2002-2003 and 2004-2005), and Vanguard Airlines (2002-2003)

[25] For Alaska Airlines, American Airlines, and United Airlines, we match with parent company data to obtain the market-to-book ratio. In the final sample, firm-level financial data are mainly from the Form-41 database. When necessary financial data are missing, we use the data from Compustat.

[26] The airlines in the sample are: AirTran Airways Corporation, Alaska Airlines Inc., Allegiant Air, American Airlines Inc., Atlas Air Inc., Continental Airlines Inc., Delta Air Lines Inc., Endeavor Air Inc., Frontier Airlines, Hawaiian Airlines Inc., JetBlue Airways, Kitty Hawk Aircargo, Kitty Hawk International, Mesa Airlines Inc., Northwest Airlines Inc., Reno Air Inc., Republic Airlines, SkyWest Airlines Inc., Southwest Airlines Co., Spirit Air Lines, Tower Air Inc., Trans World Airways LLC, US Airways Inc., United Airlines Inc., and Vanguard Airlines Inc.

[27] Our results are robust if we use the *Renegotiability* measures in the last fiscal year.

negative and significant β for Public/AT or Bank/AT $\times$ # Creditor would provide evidence supporting the assumption.[28]

Table 1.15 presents the results. In Panel A, we use Public/AT and Bank/AT as proxies for the renegotiability of corporate debt. We first present the effect of the leverage ratio (TotalDebt/AT) on the average wage per employee as a benchmark in the first two columns and then take debt structure into consideration in the subsequent columns. Public/AT, Bank/AT, and TotalDebt/AT are all standardized by their own standard deviations.

The estimations in columns (1) and (2) show that management receives better bargaining outcomes when a firm's leverage ratio is higher. Such evidence is consistent with the results in Towner (2015) in which he shows that hospitals with higher leverage ratios receive better bargaining outcomes, that is, reimbursement rates are higher from insurance companies. Our paper differs from Towner (2015) that we further take debt structure into consideration. We present the results in columns (3)-(6).

In columns (3) and (4), the results show that an increase in the leverage through public debt is associated with a decrease in the average wage per employee. The estimations suggest that management does receive better bargaining outcomes when more debt that is not easily renegotiable exists in the capital structure. Based on the result in column (3), ceteris paribus, the annual average wage per employee is 5.8% lower with a one-standard-deviation increase in the ratio of public debt to total assets (16.6%). Given that the average wage per employee in the sample is $57,353 and the average total employment is 27,463 employees, the estimation suggests that a one-percentage-point increase in the ratio of public debt to total assets is associated with 5.50 million reductions in salaries per year (2010 dollars) for an average airline. In columns (5) and (6), the estimations for bank debt are positive and insignificant, suggesting that an increase in the leverage through bank debt has little impact on the bargaining outcomes on average. Such evidence is consistent with the argument that bank debt is relatively easier to be renegotiated and on average imposes a weaker bankruptcy threat to employees.[29]

In Panel B, we further present the effects of creditor dispersion within bank debt on the average wage per employee. The results in columns (1) and (2) suggest that the effect of bank debt on wage contracts is more negative and significant when the average number of creditors in outstanding loan deals is larger. In particular, the result in column (1) suggests that, with one more bank creditor, the annual wage per employee decreases by 1.9% when the ratio of bank debt to assets increases by one-standard-deviation (13.4%). Overall, the

[28] Even though leasing contracts are widely used in the airline industry (Benmelech and Bergman, 2008), the leasing payment cannot be served as a commitment device, since missing a payment would not trigger a Chapter 11 filing.

[29] Our results are robust if we additionally control the leverage through bank debt and the leverage through other debt in the regressions.

results in Table 1.15 suggest that management can receive better bargaining outcomes when renegotiating debt is more difficult in the capital structure.[30]

Overall, the suggestive evidence in this section provides support to the assumption that debt structure affects the outcomes of contract negotiations. In the following sections, we turn to testing whether a firm's management adjusts debt structure as a response to an increase in employees' bargaining power *ex ante* in order to be in a better bargaining position *ex post* in the future. We first describe the identification strategy and then present evidence showing that an increase in the bargaining power of employees leads a firm's management to adjust debt structure to decrease the ease of renegotiating debt contracts.

[30]The inclusion of the negative earnings dummy controls an airline's financial condition and therefore mitigates the concern that the decrease in the wage per employee is due to the worsened financial condition in the firm. Also one alternative interpretation of the estimations in Table 1.15 is that firms with more dispersed debt holdings may hire more part-time employees to gain operating flexibility and the average wage per employee would be lower as a result. However, variance decomposition shows that the within firm variation of the fraction of part-time employment in total employment (total part-time employment) is small in the sample. In particular, 91% (88%) of total variation comes from cross-firm variation. As a result, the estimations with firm fixed effects in Table 1.15 cannot be explained away by this alternative channel.

1.8 Conclusion

In this paper, we provide empirical evidence showing that debt structure, instead of level of debt, is essential for influencing management's bargaining positions relative to employees. First, using NLRB labor union election as a laboratory setting, we show that debt structure is adjusted toward debt that is more difficult to be renegotiated *ex ante* as a response to an increase in employees' power. Furthermore, we show that debt structure adjustments are more likely driven by management's strategic concerns rather than more constrained access to bank loan markets after union certification. Finally, using the airline industry as the empirical setting, we show that debt structure has an impact on the *ex post* outcomes of wage contract negotiations.

Even though in this paper we focus on the interactions between management and labor, the documented findings have more general implications. As long as bankruptcy procedure imposes larger costs on non-financial stakeholders than out-of-court workouts (e.g., lessors), debt structure could serve as a strategic bargaining tool, since it alters the credibility of bankruptcy threats to non-financial stakeholders.

Figure 1.1: Number of Elections: Year Distribution

This figure shows the year distribution of the number of elections in the sample.

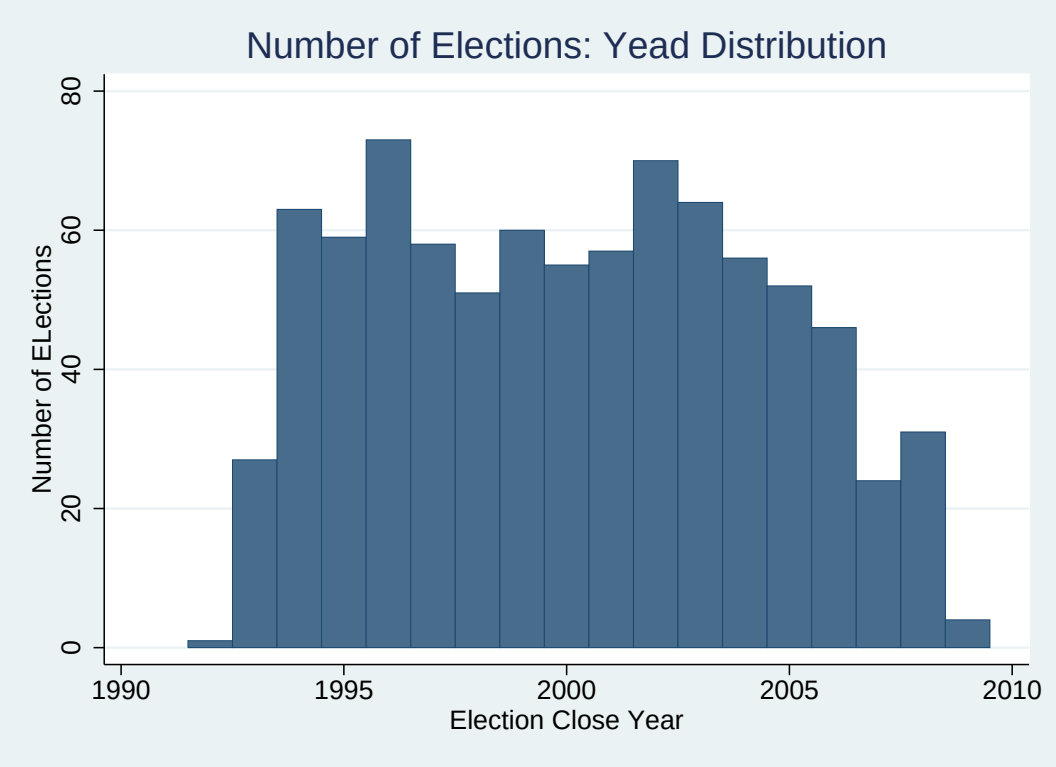
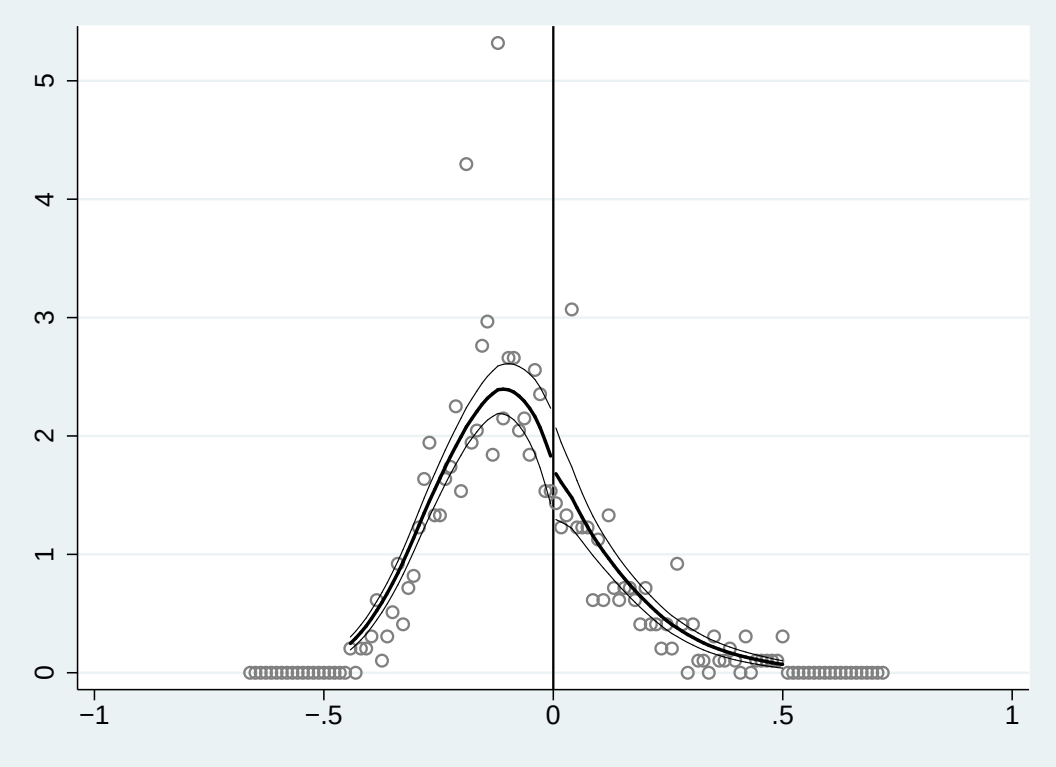


Figure 1.2: Vote Share Manipulation Tests

This figure shows the vote share density test developed in McCrary (2008) using a triangular kernel with a bandwidth of 0.216. The x-axis is the vote share for unions, and the solid line is the fitted density with a 95% confidence interval around it. The discontinuity estimate is -0.028, and the corresponding standard error is 0.173.



McCrary's Formal Test: T-statistics = -0.162

Figure 1.3: Graphical Analysis: Corporate Leverage Ratio

This figure presents regression discontinuity plots and examines the relation between the corporate leverage ratio and vote share for unions non-parametrically. The upper and lower plots present the results for book and market leverage, respectively. In each plot, we use the optimal bandwidths in the estimations, and each dot represents the average of debt structure adjustment in a 2% bin. The dots are fitted using a linear line on each side of the 50% cutoff. The shaded area in each plot represents the 95% confidence interval. *Total Debt/AT* and *Total Debt/MV* represent the ratio of total debt to total assets and market value, respectively.

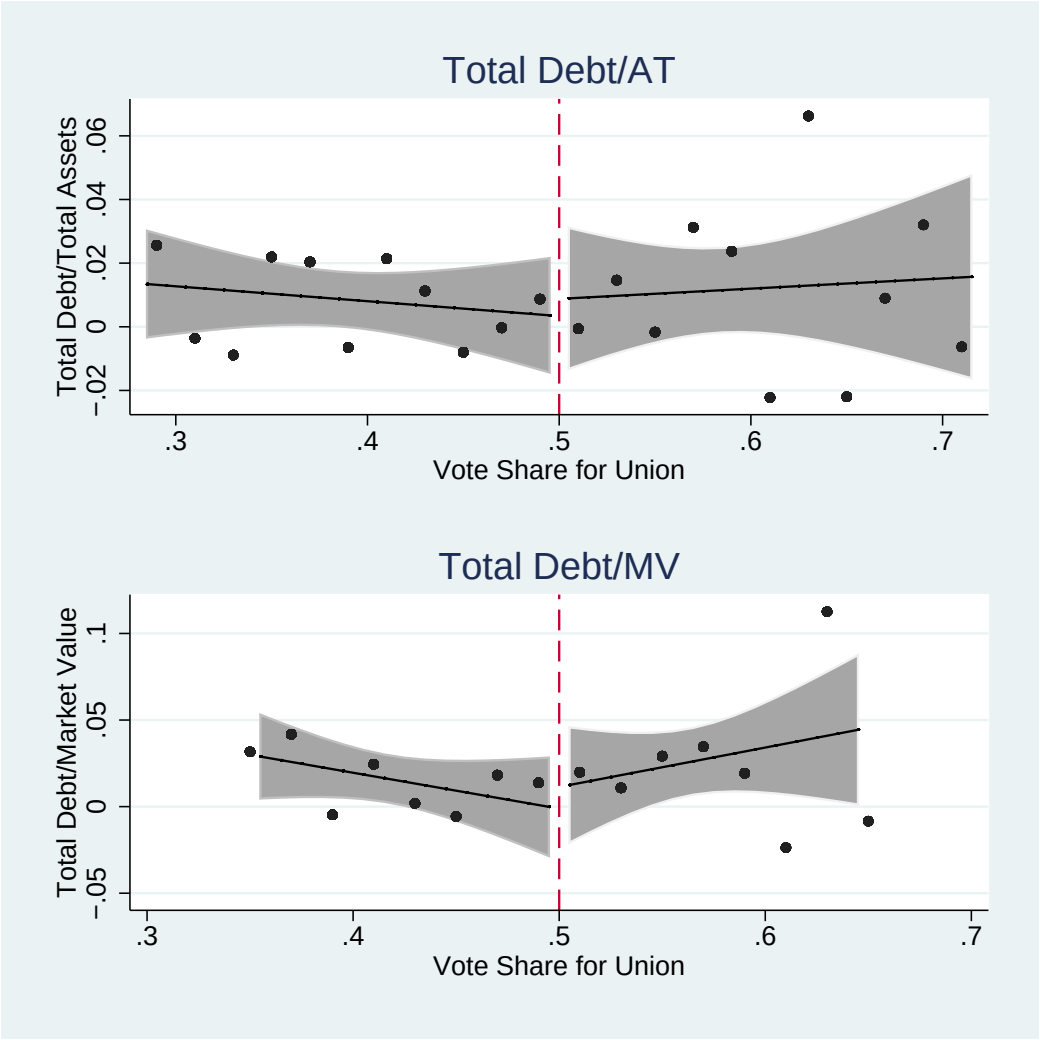


Figure 1.4: Graphical Analysis: Debt Structure

This figure presents regression discontinuity plots and examines the relation between debt structure adjustment and vote share for unions non-parametrically. The left and right plots present the results for public and bank debt, respectively. In each plot, we use the optimal bandwidths in the estimations, and each dot represents the average of debt structure adjustment in a 2% bin. The dots are fitted using a linear line on each side of the 50% cutoff. The shaded area in each plot represents the 95% confidence interval. *Public/AT* and *Bank/AT* represent the ratio of public and bank debt to total assets, *Public/MV* and *Bank/MV* represent the ratio of public and bank debt to market value, and *Public/Debt* and *Bank/Debt* represent the ratio of public and bank debt to total debt.

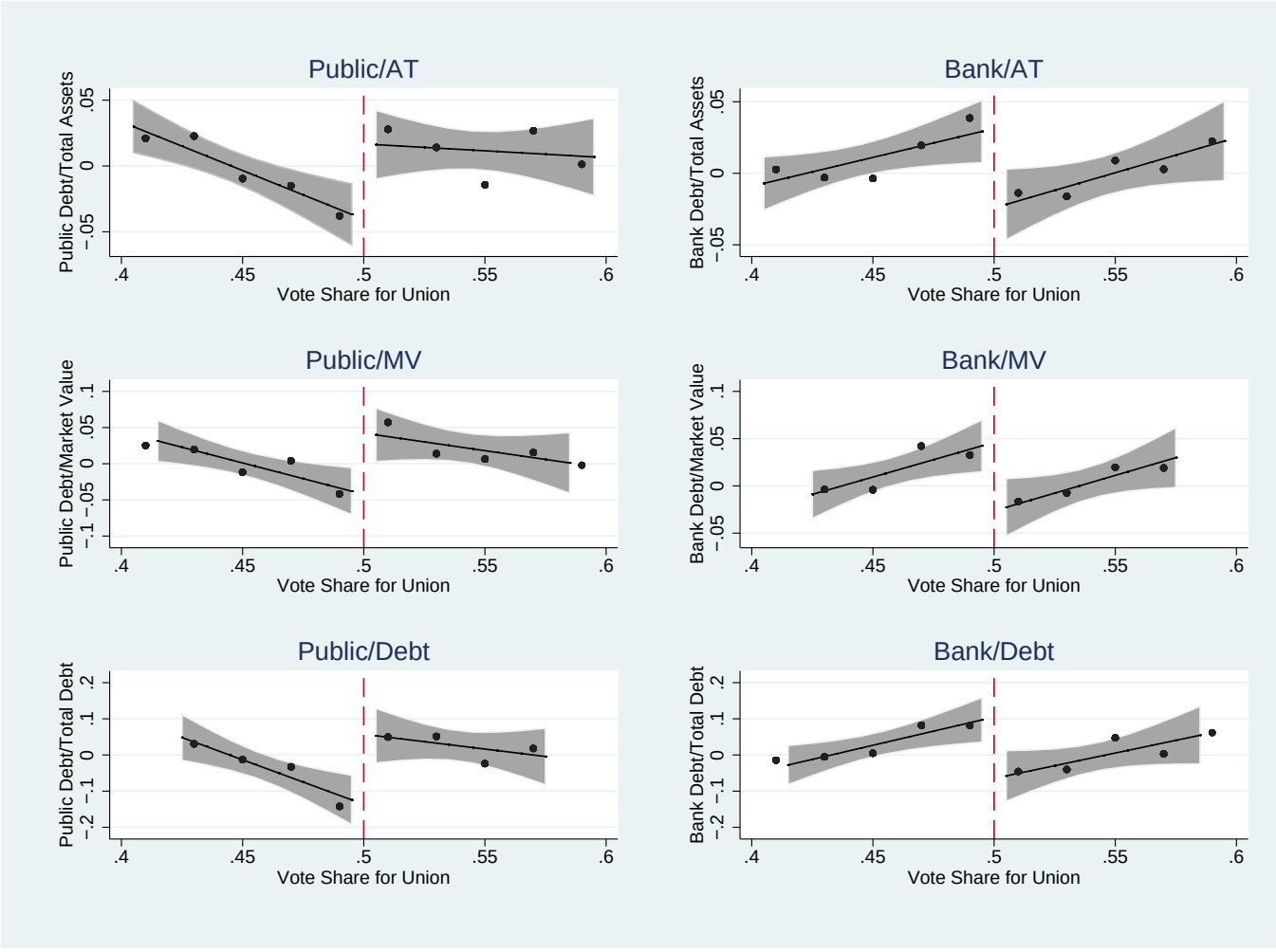


Figure 1.5: Local Linear RD Estimations with Varying Bandwidths

This figure presents the robustness of our main results to alternative choices of bandwidths. All results are estimated using local linear regressions with rectangular kernels. The x-axis represents the bandwidths varying from 0.01 to 0.5. The plots on the left- and right-hand sides represent results for public and bank debt, respectively. The solid line represents the local linear estimations, and dotted lines represent the 95% confidence intervals. The vertical line in each plot represents the estimated results with the optimal bandwidths in Imbens and Kalyanaraman (2012). *Public/AT* and *Bank/AT* represent the ratio of public and bank debt to total asset, *Public/MV* and *Bank/MV* represent the ratio of public and bank debt to market value, and *Public/Debt* and *Bank/Debt* represent the ratio of public and bank debt to total debt.

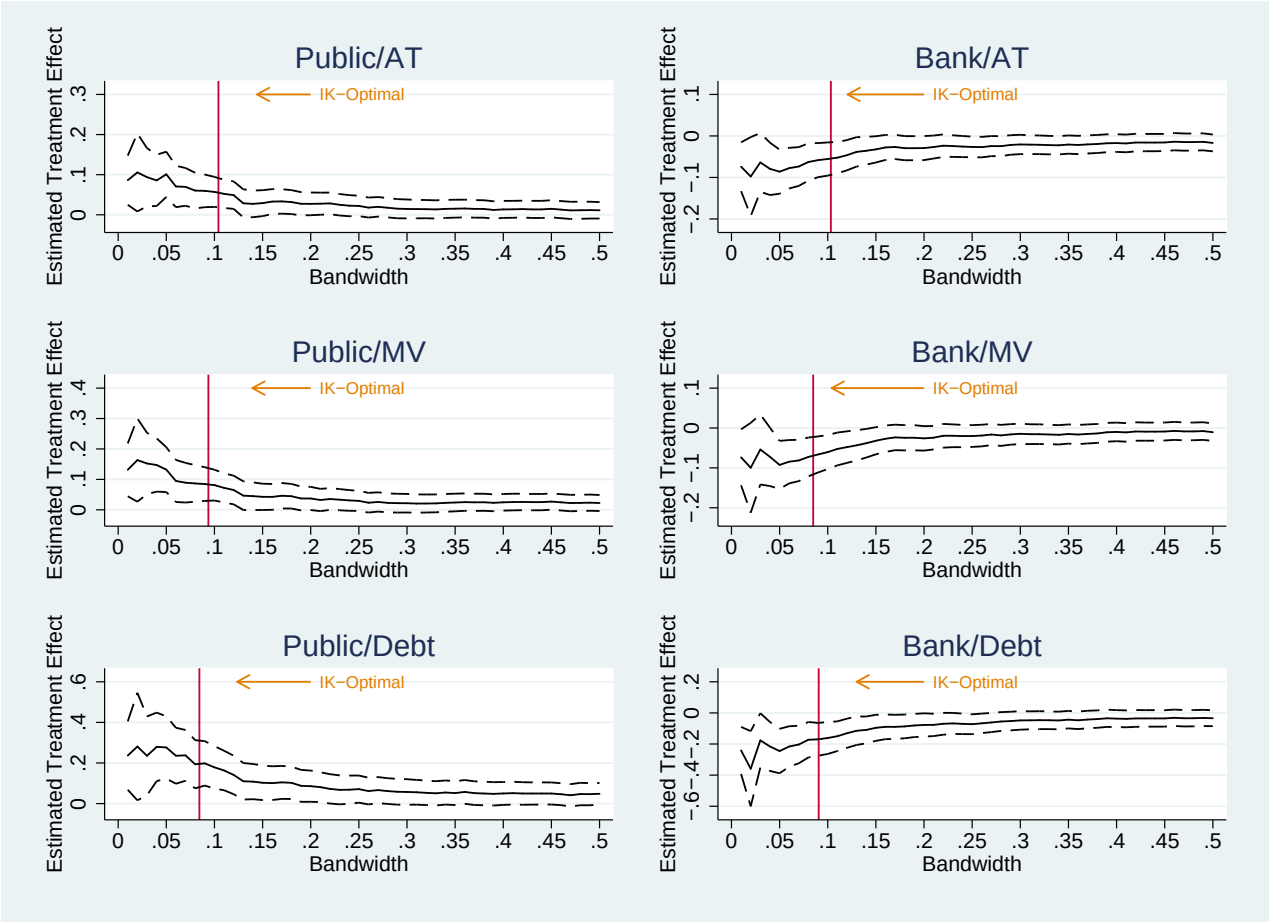


Figure 1.6: Placebo Effects of Union Certification on Debt Structure Adjustment

This figure presents the results of placebo tests. The placebo tests are implemented as follows. We first randomly choose a number other than 50% between 0.3 and 0.7 as the artificial winning threshold and then estimate the effect of union certification on debt structure adjustment as in Table 1.5. The results are estimated using local linear regressions with the optimal bandwidths and rectangular kernels. This exercise is repeated 5,000 times, and the histograms of the estimation results are reported in panels (a) to (f). The vertical lines represent the estimated results presented in Table 1.5 when the winning threshold is 50%. *Public/AT* and *Bank/AT* represent the ratio of public and bank debt to total asset, *Public/MV* and *Bank/MV* represent the ratio of public and bank debt to market value, and *Public/Debt* and *Bank/Debt* represent the ratio of public and bank debt to total debt.

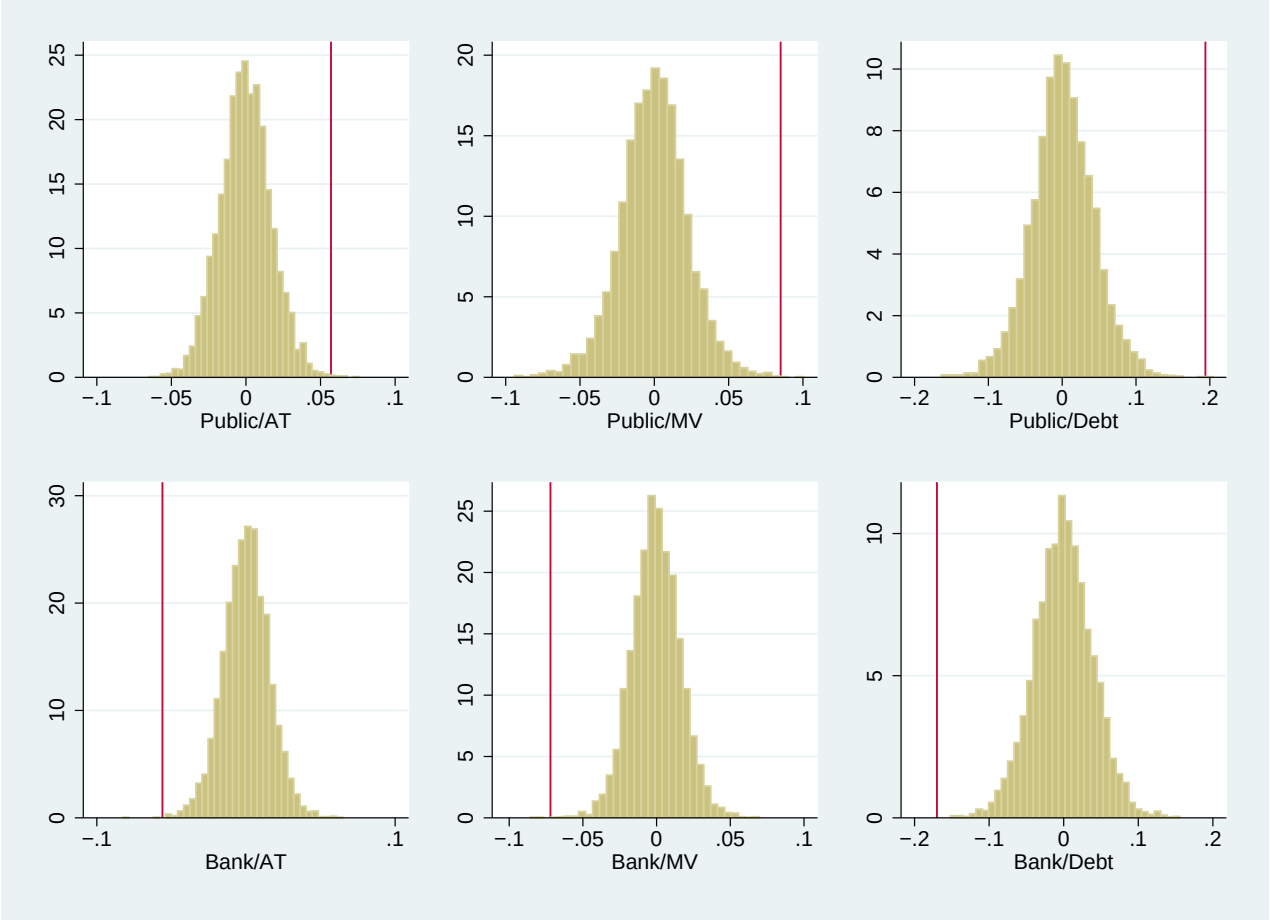


Table 1.1: Summary Statistics

This table presents the summary statistics of data in the sample. The variable details are in Appendix A.2. Panel A presents the summary statistics for debt structure measures based on balance sheet and debt issuance behavior. The balance sheet data are from one fiscal year before to three fiscal years after each labor union election and the new issuance data are within 36 months after each labor union election. *Public/AT* and *Bank/AT* represent the ratio of public and bank debt to total assets, *Public/MV* and *Bank/MV* represent the ratio of public and bank debt to market value, and *Public/Debt* and *Bank/Debt* represent the ratio of public and bank debt to total debt. *PublicIssue* is a dummy variable equal to one if a firm issues at least one public debt within 36 months after each labor union election and zero otherwise. *PrivateIssue* is a dummy variable equal to one if a firm issues at least one non-Rule 144-A private placement within 36 months after each labor union election and zero otherwise. *LoanIssue* is a dummy variable equal to one if a firm issues at least one bank loan within 36 months after each labor union election and zero otherwise. *SyndSize1* is the number of creditors in each bank loan tranche. *SyndSize2* is the number of creditors in each bank loan deal. *HHI* is a measure for creditor ownership concentration in each bank loan tranche and is defined as the sum of the square of each creditor's ownership in each loan tranche. Panel B presents the statistics for labor union election data. *Vote Shares for Unions* represents the vote shares for unions in each election. *WIN* is a dummy variable equal to one if a union wins an election and zero otherwise. Panels C presents the distribution of number and passage rate of elections by industry (one-digit SIC).

Panel A: Debt Structure				
	N	Mean	Std. Dev.	Median
Balance Sheet				
Public/AT	851	0.215	0.137	0.208
Public/MV	851	0.216	0.163	0.188
Public/DEBT	851	0.680	0.320	0.792
Bank/AT	851	0.071	0.098	0.019
Bank/MV	851	0.077	0.112	0.015
Bank/DEBT	851	0.229	0.298	0.076
New Issuance				
PublicIssue	851	0.501	0.500	1.000
PrivateIssue	851	0.090	0.287	0.000
LoanIssue	851	0.814	0.389	1.000
Syndication Structure				
SyndSize1	1269	7.680	6.841	6.000
SyndSize2	1259	7.788	7.094	6.000
HHI	525	0.259	0.286	0.125

Panel B: Election Statistics

	N	Mean	Std.Dev.	Median
Vote Shares for Unions	851	0.423	0.168	0.405
WIN	851	0.281	0.450	0.000

Panel C: Election Industry Distribution

SIC	Description	# of Elections	Passage Rate
0	Agriculture	2	100%
1	Mining	16	18.75%
2	Light Manufacturing	293	26.28%
3	Heavy Manufacturing	279	27.24%
4	Transportation	48	25.00%
5	Wholesale Trade	119	16.81%
7	Services	45	44.44%
8	Health Services	48	60.42%
9	Public Administration	1	0.00%

Table 1.2: Tests of Discontinuities in the Level of Predetermined Characteristics

This table presents the test results for the null hypothesis that there is no systematic difference in the predetermined level of firm characteristics between firms in which unions barely win elections (treatment group) and firms in which unions barely lose elections (control group). We implement an RD estimation with a rectangular kernel and the optimal bandwidth for each predetermined firm characteristic including debt structure measures, firm size, book leverage, market leverage, market-to-book ratio, tangibility, ROA, modified Z-score, and cash holding. All RD estimations include vote shares allowing for different intercepts and slopes on each side of the cutoff. Standard errors are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

Variables:	Coeff.	Z-stat Value
Outcome Variables		
Public/AT	-0.007	-0.318
Public/MV	-0.001	-0.042
Public/Total Debt	-0.045	-0.684
Bank/AT	0.010	0.507
Bank/MV	0.023	0.988
Bank/Total Debt	0.024	0.630
Firm Characteristics		
Log(AT)	0.098	0.541
BookLev	-0.018	-0.911
MarkLev	-0.014	-0.471
MTB	-0.056	-0.763
Tangibility	0.010	0.450
ROA	-0.008	-0.992
Modified Z-score	0.053	0.349
Cash Holding	0.003	0.356

Table 1.3: Unionization and Debt Structure: OLS Evidence

This table presents the OLS evidence on the effect of labor unionization on debt structure. *Unionized* is a dummy variable equal to one if some fraction of employees are covered by collective bargaining agreements and zero otherwise. All regressions include firm-level controls including firm size (Ln(AT)), ROA, market-to-book ratio (MTB), tangibility, modified Z-score, and dividend payer dummy. SIC2 $\times$ Year fixed effects are included in all regressions. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	Leverage	Public/AT	Bank/AT
	(1)	(2)	(3)
Unionized	0.012**	0.013***	0.003
	[0.005]	[0.005]	[0.005]
Ln(AT)	0.015***	0.022***	-0.013***
	[0.001]	[0.001]	[0.001]
ROA	-0.009	-0.030**	0.005
	[0.007]	[0.013]	[0.011]
MTB	-0.010***	-0.000	-0.009***
	[0.001]	[0.001]	[0.001]
Tangibility	0.172***	0.052***	0.089***
	[0.013]	[0.012]	[0.013]
Modified Z-score	-0.002***	-0.002***	0.002***
	[0.000]	[0.000]	[0.000]
Dividend Payer	-0.059***	-0.023***	-0.031***
	[0.005]	[0.004]	[0.004]
SIC2 $\times$ Year FE	Y	Y	Y
R^2	0.237	0.127	0.121
N	32943	32943	32943

Table 1.4: Do Firms Adjust the Level of Debt as a Response to Union Certification?

This table presents the adjustment of the corporate leverage ratio to union certification. Book leverage is defined as the ratio of total debt to total assets, and market leverage is defined as the ratio of total debt to market value. Panels A and B present the results for book and market leverage, respectively. In each panel, we use various bandwidths and rectangular kernels in local linear regressions. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

Panel A: Book Leverage				
	Optimal	5%	10%	15%
WIN	0.005	-0.001	-0.004	0.000
	[0.016]	[0.032]	[0.024]	[0.020]
Bandwidth	0.221	0.050	0.100	0.150
N	643	147	311	463
Panel B: Market Leverage				
	Optimal	5%	10%	15%
WIN	0.013	0.001	0.009	0.013
	[0.027]	[0.046]	[0.032]	[0.027]
Bandwidth	0.149	0.050	0.100	0.150
N	463	147	311	463

Table 1.5: Do Firms Adjust Debt Structure as a Response to Union Certification?

This table presents the adjustment of debt structure to union certification. We use six measures throughout the analysis: public or bank debt scaled by total assets, public or bank debt scaled by market value and public or bank debt scaled by total debt. All results are estimated using local linear regressions with the optimal bandwidths. Panels A and B present the estimation results using rectangular and triangular kernels, respectively. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

Panel A: Rectangular Kernel						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	0.057***	0.085***	0.194***	-0.056***	-0.072***	-0.170***
	[0.019]	[0.028]	[0.061]	[0.020]	[0.025]	[0.054]
Bandwidth	0.104	0.094	0.084	0.103	0.085	0.091
N	311	274	242	311	242	274
Panel B: Triangular Kernel						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	0.054***	0.086***	0.205***	-0.056***	-0.070***	-0.176***
	[0.019]	[0.028]	[0.057]	[0.020]	[0.023]	[0.053]
Bandwidth	0.133	0.119	0.107	0.131	0.108	0.115
N	403	364	338	403	338	364

Table 1.6: Do Firms Issue More Public Debt?

This table presents results for new issuance of public debt, non-Rule 144-A private placement, and bank loan. The first three columns present results for the issuance probability, and the last three columns present results for the percentage of each type of debt's new issuance amount in total new issuance amount. Public debt (Pub.) includes both public corporate bond and Rule 144-A private placement. Private placement (Pri.) includes non-Rule 144-A private placement. All results are estimated using local linear regressions with optimal bandwidths and rectangular kernels. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	Prob.			% in Total Amt.		
	Pub.	Pri.	Loan	Pub.	Pri.	Loan
WIN	0.272**	-0.122**	0.101	0.211*	-0.035	-0.191
	[0.129]	[0.056]	[0.071]	[0.120]	[0.026]	[0.122]
Bandwidth	0.084	0.117	0.150	0.072	0.172	0.069
N	242	364	463	179	455	179

Table 1.7: Does Unions' Bargaining Power Matter?

This table presents the debt structure adjustment to union certification conditional on unions' bargaining power. Panels A and B present results conditional on whether the election states have adopted the RTW laws at the time of election. Panels C and D present results conditional on election size, defined as the fraction of eligible voters in a firm's total employment. Large (small) elections are defined as the elections that rank in the top (bottom) half in the sample according to the election size. All results are estimated using local linear regressions with optimal bandwidths and rectangular kernels. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

Panel A: Non-RTW						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	0.067***	0.113***	0.200***	-0.063**	-0.080**	-0.188***
	[0.020]	[0.034]	[0.068]	[0.027]	[0.031]	[0.067]
Bandwidth	.105	.093	.089	.101	.089	.105
N	235	189	189	214	189	214
Panel B: RTW						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	0.003	0.026	0.079	-0.021	-0.022	-0.071
	[0.032]	[0.044]	[0.080]	[0.021]	[0.033]	[0.064]
Bandwidth	0.127	0.117	0.131	0.198	0.111	0.154
N	127	114	127	201	103	148
Panel C: Large Elections: Fraction of eligible voters in total employment $\geq$ 1.1%						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	0.063**	0.102***	0.317***	-0.090**	-0.118***	-0.286***
	[0.028]	[0.036]	[0.088]	[0.035]	[0.043]	[0.085]
Bandwidth	0.096	0.102	0.068	0.093	0.070	0.071
N	163	163	110	143	110	110
Panel D: Small Elections: Fraction of eligible voters in total employment $<$ 1.1%						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	0.026	0.031	0.106	-0.026	-0.029*	-0.077
	[0.027]	[0.036]	[0.066]	[0.018]	[0.017]	[0.054]
Bandwidth	0.128	0.129	0.117	0.186	0.216	0.171
N	181	181	165	269	309	248

Table 1.8: Do Bankruptcy Costs Borne by Unions Matter?

This table presents the adjustment of debt structure as a response to union certification conditional on predetermined bankruptcy costs expected to be borne by unions. We use a firm's underfunding status of DB pension plans as a proxy for unions' bankruptcy costs. The pension data come from Compustat Pension Annual Database. DB pension plan deficit is defined as the difference between projected benefit obligations and fair value of pension assets. We define unions with high (low) bankruptcy costs as the firms in which DB pension plans are underfunded one fiscal year before elections. Panels A and B present results for labor unions with high and low bankruptcy costs, respectively. All results are estimated using local linear regressions with optimal bandwidths and rectangular kernels. Standard errors are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

Panel A: Unions with High Expected Bankruptcy Costs						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	0.121***	0.109**	0.243**	-0.106***	-0.098***	-0.199**
	[0.039]	[0.043]	[0.093]	[0.032]	[0.034]	[0.090]
Bandwidth	0.071	0.102	0.092	0.068	0.074	0.084
N	90	129	115	90	90	104
Panel B: Unions with Low Expected Bankruptcy Costs						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	-0.016	0.002	0.017	-0.017	-0.028	-0.101
	[0.030]	[0.035]	[0.072]	[0.022]	[0.025]	[0.075]
Bandwidth	0.141	0.191	0.135	0.178	0.161	0.135
N	151	200	144	191	172	144

Table 1.9: Do Employees' Outside Options Matter?

This table presents the adjustment of debt structure as a response to union certification conditional on the outside options of employees. We use the number of local rivals, specifically the number of rivals in the 2-digit SIC industry within a 50-mile radius around a firm's headquarters, as a proxy for the employees' outside options. Employees are defined to have more (fewer) outside options if the number of local rivals is above (below) the sample median. Panels A and B present results for employees with fewer and more outside options, respectively. All results are estimated using local linear regressions with optimal bandwidths and rectangular kernels. Standard errors are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

Panel A: Fewer Outside Options						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	0.074**	0.149***	0.191**	-0.079**	-0.080*	-0.185**
	[0.034]	[0.048]	[0.081]	[0.035]	[0.041]	[0.082]
Bandwidth	0.100	0.085	0.116	0.080	0.078	0.105
N	106	85	125	85	85	114
Panel B: More Outside Options						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	0.032	-0.007	0.143	-0.035	-0.057	-0.113
	[0.028]	[0.038]	[0.094]	[0.033]	[0.036]	[0.087]
Bandwidth	0.116	0.140	0.090	0.110	0.096	0.103
N	154	183	118	143	133	133

Table 1.10: Robustness Checks

This table presents robustness checks for estimations in Table 1.5. In Panels A and B, we use alternative bandwidths and implement local linear estimations with rectangular kernels. In Panel C we include predetermined firm characteristics including firm size, market-to-book ratio, tangibility, ROA, and modified Z-score, and we use optimal bandwidths in Panel C. Panels D and E present estimations for alternative sample selections for labor union elections. Panel F presents the donut-RD estimations for the sample in which elections with a margin of victory (MOV) equal to one are excluded. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

Panel A: 5% Bandwidth						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	0.066***	0.080***	0.199***	-0.059***	-0.052**	-0.149***
	[0.020]	[0.027]	[0.055]	[0.019]	[0.022]	[0.055]
N	317	317	317	317	317	317
Panel B: 10% Bandwidth						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	0.049***	0.059***	0.132***	-0.035**	-0.035**	-0.097**
	[0.015]	[0.020]	[0.043]	[0.016]	[0.016]	[0.042]
N	428	428	428	428	428	428
Panel C: Including Predetermined Firm Characteristics						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	0.059***	0.096***	0.180**	-0.059**	-0.082***	-0.201***
	[0.021]	[0.032]	[0.070]	[0.023]	[0.028]	[0.061]
Bandwidth	0.104	0.094	0.084	0.103	0.085	0.091
N	269	237	212	269	212	237

Panel D: First Election in Each Firm-Year						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	0.042**	0.062**	0.174***	-0.059***	-0.061***	-0.158***
	[0.018]	[0.025]	[0.054]	[0.020]	[0.022]	[0.049]
Bandwidth	0.122	0.110	0.093	0.105	0.103	0.104
N	360	334	264	303	303	303
Panel E: All Elections						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	0.043**	0.052*	0.158***	-0.037**	-0.061***	-0.148***
	[0.020]	[0.026]	[0.049]	[0.017]	[0.023]	[0.055]
Bandwidth	0.100	0.1071	0.086	0.111	0.075	0.079
N	385	421	343	421	262	302
Panel F: Exclude MOV = 1						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	0.043**	0.065**	0.150**	-0.039	-0.052*	-0.146**
	[0.022]	[0.032]	[0.073]	[0.023]	[0.031]	[0.064]
Bandwidth	0.104	0.094	0.084	0.103	0.085	0.091
N	291	254	222	291	222	254

Table 1.11: Does Union Certification Affect Bank Loan Syndication Structure?

This table presents the effect of union certification on the syndication structure of newly issued bank loans within 36 months after union certification. All results are estimated using local linear regressions with the optimal bandwidths and rectangular kernels. *Log(Amt)* is the natural logarithm of the average loan amount. *Log(Syndsize1)* is the natural logarithm of the average syndication size defined at the loan tranche level. *Log(Syndsize2)* is the natural logarithm of average syndication size defined at the loan deal level. *Log(HHI)* is the natural logarithm of ownership concentration, which is defined as the sum of the square of each creditor's ownership in each loan tranche. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	Log(Syndsize1)	Log(Syndsize2)	Log(HHI)	Log(Amt)
	(1)	(2)	(3)	(4)
WIN	0.347**	0.302*	-0.502**	0.098
	[0.174]	[0.177]	[0.246]	[0.239]
Bandwidth	0.131	0.128	0.170	0.144
N	566	562	322	607

Table 1.12: Does Union Certification Affect Other Firm Characteristics?

This table presents the effects of union certification on the changes in firm characteristics that are important for the choice of debt structure. A change in a firm characteristic is defined as the difference between the average value in the following three years after an election and the value one year before the election. The definition of each firm characteristic is available in Appendix A.2. All results are estimated using local linear regressions with the optimal bandwidths. Panels A and B present the estimation results using rectangular and triangular kernels, respectively. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	Panel A: Rectangular									
	MTB	Tangibility	R&D	Capex	ROA	TFP	Z-score	Credit Rating	Down grade	Bid-Ask Spread
WIN	-0.044	-0.011	0.000	-0.003	-0.003	-0.034	-0.321	0.314	-0.020	0.002
	[0.093]	[0.012]	[0.001]	[0.006]	[0.010]	[0.050]	[0.210]	[0.890]	[0.112]	[0.007]
Bandwidth	0.194	0.136	0.131	0.172	0.102	0.096	0.145	0.165	0.097	0.125
N	565	425	400	517	310	282	446	521	310	356
	Panel B: Triangular									
	MTB	Tangibility	R&D	Capex	ROA	TFP	Z-score	Credit Rating	Down grade	Bid-Ask Spread
WIN	-0.029	-0.014	0.001	-0.002	-0.002	-0.022	-0.343	0.051	0.021	0.002
	[0.088]	[0.012]	[0.001]	[0.006]	[0.010]	[0.049]	[0.208]	[0.942]	[0.111]	[0.007]
Bandwidth	0.2478	0.173	0.167	0.219	0.130	0.122	0.185	0.211	0.123	0.159
N	689	521	521	635	400	326	532	614	363	489

Table 1.13: The Effects of Union Certification on Spreads of Bank and Public Debt

This table presents the effects of union certification on the spreads of public debt and bank loans. Panels A and B present results for bank loans and public debt, respectively. Public debt includes both public corporate bond and Rule 144-A private placement. The analysis is conducted at the debt instrument level in the following 24, 36, 48, and 60 months after elections. All results are estimated using local linear regressions with the optimal bandwidths. All regressions control debt-level characteristics and the average of spread before elections. Standard errors are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	Panel A: Bank Debt			
Estimation Window:	(0,24]	(0,36]	(0,48]	(0,60]
WIN	75.078**	69.029**	50.694*	29.937
	[37.515]	[29.375]	[29.790]	[26.627]
Bandwidth	0.066	0.066	0.067	0.094
N	222	351	464	730
	Panel B: Public Debt			
Estimation Window:	(0,24]	(0,36]	(0,48]	(0,60]
WIN	93.184**	50.156	80.564**	81.608**
	[44.341]	[35.671]	[35.622]	[37.888]
Bandwidth	0.118	0.121	0.132	0.133
N	221	310	456	583

Table 1.14: Does the Interest Alignment between Labor and Management Matter?

This table presents the adjustment of debt structure as a response to union certification conditional on the predetermined interest alignment between labor and management. The interest alignment is measured by (1) the fraction of DC pension assets invested in a firm's stock or (2) the fraction of a firm's equity value held by employees through DC pension assets (DC pension ownership). Panels A and B present results for firms with smaller and larger fraction of the DC pension assets invested in a firm's stock, respectively. Panels C and D present results for firms with smaller and larger DC pension ownership, respectively. All results are estimated using local linear regressions with optimal bandwidths and rectangular kernels. Standard errors are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

Panel A: Fraction of DC Pension Assets Invested in the Firm's Stock $< 6.5\%$						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	0.078**	0.094**	0.170*	-0.110***	-0.124***	-0.139
	[0.034]	[0.046]	[0.093]	[0.040]	[0.042]	[0.088]
Bandwidth	0.131	0.121	0.141	0.106	0.105	0.147
N	73	66	79	58	58	86
Panel B: Fraction of DC Pension Assets Invested in the Firm's Stock $\geq 6.5\%$						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	-0.006	0.025	0.108	-0.064	0.030	-0.143
	[0.030]	[0.050]	[0.136]	[0.052]	[0.044]	[0.152]
Bandwidth	0.280	0.198	0.115	0.094	0.132	0.094
N	145	113	63	44	72	44
Panel C: DC Pension Ownership $< 0.18\%$						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	0.082**	0.086*	0.207**	-0.102**	-0.117***	-0.137
	[0.034]	[0.045]	[0.098]	[0.039]	[0.042]	[0.084]
Bandwidth	0.116	0.116	0.115	0.110	0.101	0.142
N	75	75	66	66	59	87
Panel D: DC Pension Ownership $\geq 0.18\%$						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	-0.002	0.041	0.100	-0.017	0.020	-0.004
	[0.029]	[0.048]	[0.119]	[0.034]	[0.036]	[0.105]
Bandwidth	0.268	0.195	0.113	0.115	0.151	0.122
N	153	123	63	68	94	68

Table 1.15: Does Debt Structure Affect Wage Contract Negotiation Outcomes?

This table presents the effects of debt structure on the outcomes of wage contract negotiations in the airline industry. All regressions control firm size, profitability, market-to-book ratio, tangibility, and negative earning dummy, which is one if an airline's earning is non-positive in a given year and zero otherwise. The dependent variable in all regressions is the natural logarithm of the annual wage per employee. *Public/AT*, *Bank/AT*, and *TotalDebt/AT* are standardized by their own standard deviations. *# Creditor* is the average number of creditors in outstanding loan deals in a given year. Standard errors in parentheses are robust and clustered at the airline level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	Panel A: Public Debt vs. Bank Loan					
	(1)	(2)	(3)	(4)	(5)	(6)
TotalDebt/AT	-0.054***	-0.088**				
	[0.019]	[0.037]				
Public/AT			-0.044**	-0.058*		
			[0.021]	[0.032]		
Bank/AT					0.004	0.024
					[0.024]	[0.028]
Firm Size	0.096***	0.004	0.098***	-0.028	0.099***	-0.032
	[0.020]	[0.139]	[0.019]	[0.168]	[0.021]	[0.173]
Profitability	-0.157	0.076	-0.074	0.288	-0.066	0.369
	[0.123]	[0.310]	[0.147]	[0.356]	[0.166]	[0.429]
MTB	-0.078	-0.085	-0.059	-0.116	-0.037	-0.134*
	[0.064]	[0.089]	[0.063]	[0.080]	[0.059]	[0.068]
Tangibility	0.059	0.376	0.045	0.355	0.008	0.249
	[0.156]	[0.318]	[0.152]	[0.336]	[0.164]	[0.307]
Neg. Earning	0.021	0.028	0.019	0.049	0.021	0.051
	[0.042]	[0.037]	[0.042]	[0.045]	[0.045]	[0.050]
Year Fixed Effect	Y	Y	Y	Y	Y	Y
Firm Fixed Effect	N	Y	N	Y	N	Y
Adj. R^2	0.355	0.594	0.344	0.577	0.324	0.566
N	250	250	250	250	250	250

	Panel B: Within Bank Loan	
	(1)	(2)
Bank/AT×#Creditor	-0.018**	-0.019**
	[0.008]	[0.008]
Bank/AT	0.131***	0.104*
	[0.040]	[0.050]
#Creditor	-0.000	-0.008
	[0.003]	[0.007]
Ln(AT)	0.036	-0.076
	[0.023]	[0.188]
Profitability	0.799	0.725
	[0.793]	[0.752]
MTB	-0.134*	-0.182
	[0.068]	[0.107]
Tangibility	-0.017	0.093
	[0.121]	[0.268]
Neg. Earning	0.092	0.097
	[0.082]	[0.070]
Year Fixed Effect	Y	Y
Firm Fixed Effect	N	Y
Adj. R^2	0.095	0.246
N	176	176

Chapter 2

Skilled Labor Risk and Compensation Policies

2.1 Introduction

In recent decades, human capital has become increasingly important for firm productivity. Both the importance and the inalienable nature of human capital make the attraction and retention of skilled labor ever more crucial in today's businesses. In this paper, we examine firms' exposures to skilled labor risk, that is, the risk of failing to attract and retain skilled labor, and the impact of such risk on corporate compensation policies.

Our approach to identifying firms' exposures to skilled labor risk is motivated by the observation that many U.S. publicly traded companies discuss the potential failure in attracting and retaining skilled labor and key talents as a risk factor in their 10-K filings.[1] There are substantial variations both in the cross section and over time in the intensity of such discussions. We thus measure a firm's skilled labor risk in a year by the number of sentences that the firm spends discussing the reliance on and the retention of skilled labor and key talents in the 10-K.

Theories suggest that skilled labor risk arises from the mobility of skilled labor, which is closely related to their outside options. We thus examine the relation between our measure of skilled labor risk and various proxies for skilled labor's outside options and mobility. First, we examine the effect of labor market competition on firms' skilled labor risk. We find that the intensity of discussion on skilled labor risk in a firm's 10-K filings significantly increases

[1] For example, Apple stated in its 2012 10-K that "the Company's success depends largely on the continued service and availability of key personnel." A tissue product provider Cybrid, Inc. stated that "If we cannot attract skilled personnel, our operations will likely suffer and any competitive edge that we have in the marketplace will quickly erode." An outdoor equipment manufacturer Johnson Outdoors Inc. stated that "The loss of key personnel, or the failure to attract qualified personnel, could have a material adverse effect on our business, financial condition or results of operations."

with the number of industry rivals in the local market, which is largely within a 50-mile radius around the firm's headquarters. In contrast, the number of local firms outside the firm's industry does not contribute to the firm's skilled labor risk, neither does the number of industry rivals outside the 50-mile radius. These results suggest that the outside options for skilled labor and key talents are largely industry-specific and local.

If skilled labor's outside options tend to be local, then state regulations and tax policies that affect labor mobility could have a large impact on firms' skilled labor risk. We find that firms headquartered in states with more stringent enforcement of non-compete agreements discuss skilled labor risk less intensively in their 10-Ks, and the discussion is also less sensitive to local labor market competition. If skilled labor and key talents are likely homeowners, then state policies that affect homeowners' mobility could have unintended consequences on skilled labor risk in local firms. For example, the state and local taxes levied on residential real estate transactions can increase the cost of moving and negatively affect home owners' mobility. Indeed, we find that in states with higher transfer tax rates on housing transactions, households are less likely to move for job-related reasons, and firms' discussion on skilled labor risk in 10-K filings is less intense and less sensitive to local labor market competition.

Attracting and retaining skilled labor may be easier if the firm has access to a larger supply of highly educated labor. We find that firms that have longer average distances to land-grant universities, which are major sources of educated labor, tend to discuss skilled labor risk more intensively. Although firms endogenously choose their headquarters locations based on the demand for highly educated labor, our estimations suggest that the supply effects dominate.

We also find that our results cannot be explained away by the firm's disclosure style (more disclosure vs. less disclosure), and that the bulk part of the information content in the skilled labor risk measure is not captured by the firm's general risk disclosures. Overall, the evidence suggests that our skilled labor risk measure does contain useful information about firms' exposures to risk arising from the mobility of their skilled labor. For firms that more intensively discuss the attraction and retention of skilled labor as a risk factor, the outside option constraints of their key employees are more likely to be binding.

If the mobility of skilled labor poses a risk to the firm's future cash flows, then it should affect compensation policies, which governs the split of surplus between the firm's owners and its employees. Theories suggest that the optimal compensation contract for key talents should be sensitive to their time-varying outside options (see, e.g., Oyer (2004) and Lustig et al. (2011)). These theories suggest that the optimal compensation contract in the presence of mobile talents involves more incentive pay, which gives the key talents a larger share of the cash flows in higher productivity states when the talents' outside options are higher. Thus,

we expect firms facing higher skilled labor risk to structure their compensation contracts for key talents more towards incentive pay.

However, empirical tests of these theoretical predictions face a challenge. If a compensation policy is effective at attracting and retaining key talents, then we expect firms with such policy to have lower skilled labor risk. This reverse causality implies that the OLS estimates of the effects of skilled labor risk on compensation policy could be biased towards zero. To overcome this challenge, we consider two instruments for firms' skilled labor risk based on the insight that skilled labor are likely to be homeowners and thus their mobility is affected by policies and housing market conditions that affect homeowners' mobility. One instrument is the historical real estate transfer tax rate in a firm's headquarters state at the beginning of our sample period. The other one is the local (MSA level) home equity shock driven by the national house price changes and the local topological elasticity of housing supply (Saiz (2010)). Both instruments significantly affect the mobility of homeowners and thus firms' skilled labor risk, and both are reasonably exogenous to firms' compensation policies for talents.

We find that the OLS estimates of the effects of skilled labor risk on compensation policy are indeed close to zero for both top executives and employees below the top rank, while the instrumental variable estimates are larger, statistically significant, and consistent with the theoretical predictions. For example, when using the historical real estate transfer tax rate as the instrument, a one-standard-deviation increase in *Skilled Labor Risk* would increase the top executive team's average incentive pay to total pay ratio by about 27%, and that of employees below the top rank by 53% relative to the sample mean. The effect is larger for employees below the top rank than for top executives, suggesting that our measure is more about the mobility of skilled labor in general than that of top executives. The 2SLS estimation using the home equity shock as the instrument yields similar results, even though the two instruments capture different sources of variation in skilled labor mobility. This gives us confidence that our identification strategy is sensible.

Firms with higher skilled labor risk also ex ante pay a higher level of compensation to attract and retain skilled labor. We infer the average compensation for employees below the top rank using information from Compustat and the Quarterly Census of Employment and Wages (QCEW) from the Bureau of Labor Statistics. Alternatively, we examine the salaries offered to highly skilled labor under the H-1B visa program. The 2SLS estimates suggest that a one-standard-deviation increase in skilled labor risk would increase the average skilled labor compensation by 12-23%. Lastly, we find that firms facing higher skilled labor risk also tend to invest more in strengthening employee relations, but such investment tends to be concentrated in employee compensation and benefits related dimensions.

This study contributes to a growing strand of research in the labor and finance literature,

which not only highlights the increasing importance of skilled labor and key talents in production, but also analyzes its implications for firm risk (e.g., Eisfeldt and Papanikolaou (2013), Ochoa (2013), Belo et al. (2016), and Israelsen (2016)), firm value (e.g., Eisfeldt and Papanikolaou (2014)), compensation design (e.g., Oyer (2004) and Lustig et al. (2011)), and capital structure (e.g., Baghai et al. (2016)and Klasa et al. (2016)). We construct a new firm-level measure of skilled labor risk using firms' own discussions on this issue in their annual filings. There are three existing measures related to firms' skilled labor risk. One is the measure of organizational capital based on firms' Selling, General, and Administrative (SG&A) expenses (Eisfeldt and Papanikolaou (2013)). Another measure is based on a firm's disclosure on "Key Man Life Insurance", which insures the firm against losses from losing certain key talents due to deaths (Israelsen (2016)). The third one measures an industry's reliance on skilled labor based on the skill level required for each occupation in an industry (Belo et al. (2016)). We believe that a key advantage of our measure relative to these related measures is that it more effectively captures firm risk due to the *mobility* of skilled labor, which allows for better understanding of skilled labor's outside options and factors that affect their mobility. Our approach also provides a way to capture skilled labor risk in all firms, and thus can potentially provide a more complete understanding of such risk. For example, public and academic discussions on skilled labor risk tend to focus on high-tech R&D intensive companies. Yet little is known about traditional low-tech companies' exposures to skilled labor risk. Our measure suggests that skilled labor risk is pervasive in the economy, and the within-industry variation in firms' skilled labor risk is much larger than the cross-industry variation.

In search of new foundations, Zingales (2000) points out that the valuation of the "new firm" characterized by the growing importance of human capital calls for better understanding of how the surplus is split between the firm's owners and its employees. Our study contributes to this discussion. Our findings suggest that skilled labor risk is an important determinant of compensation policy, and the greater mobility of skilled labor allows them to capture greater rents, particularly when their outside options are valuable. Several recent studies provide evidence suggesting that equity-based compensation matters in retaining employees. Stock option grants tend to reduce employee turnover at least during the options' vesting periods (see, e.g.,Aldatmaz et al. (2016) on evidence regarding turnover of rank-and-file employees, and Jochem et al. (2016) on CEOs). Gao et al. (2015) find that firms tend to increase equity-based pay for incumbent executives after losing top executives to other firms. Our study complements these studies by providing evidence on the *ex ante* compensation design for firms facing high skilled labor risk.

The rest of the paper is organized as follows. Section 2 presents the construction of our skilled labor risk measure and discusses its advantages and potential concerns. Section 3

presents comprehensive analysis on the information content of our skilled labor risk measure by relating it to proxies of skilled labor mobility and supply. Section 4 examines the effect of skilled labor risk on corporate compensation policies. Section 5 concludes.

2.2 Skilled Labor Risk

2.2.1 Measuring Skilled Labor Risk

We define skilled labor risk as the risk of failing to attract and retain skilled labor. To quantify firms' exposures to skilled labor risk, we develop a measure based on the textual analysis of firms' discussions on risk related to skilled labor in their 10-K filings in the SEC's EDGAR database from 1996 to 2014. The relevant discussions have been mainly in Item 1A (Risk Factors) since December 1st, 2005 when the SEC Regulation S-K Item 305(c) required U.S. publicly traded companies to explicitly discuss risk factors for investors in 10-Ks. Before this regulation, the discussions on skilled labor related risk were mainly in Item 1 (Business) and Item 7 (Management's Discussion and Analysis). As a result, we focus on these three items in 10-Ks to develop our measure.

Based on our reading of 300 randomly selected 10-K files, we develop the following three keyword lists: (1) "essential", "key", "core", "important", "skilled", "skillful", "trained", "experienced", "talented", "qualified"; (2) "worker", "(eligible) employee", "personnel", "colleague", "team member", "individual", "people", "specialist", "labor", "(professional) staff", "professional", "workforce", "scientist", "technician"; (3) "recruit(ing)/attract(ing) and/or retain(ing)", "retain(ing) and/or recruit(ing)/attract(ing)", "research profession", "scientific personnel", "effective/quality employee".[2]

Following Kravet and Muslu (2013), we use sentence rather than word as the analysis unit. We develop a Perl code to parse each of the three 10-K items into sentences and a sentence is defined to mention risk related to skilled labor if it contains a combination of a word in list (1) and a word in list (2) or it contains any phrase from list (3). For the first two phrases in list (3), we do not combine them with the keywords in lists (1) and (2) since firms sometimes do not mention skilled labor risk in this specific way.[3] In order to mitigate the concern that we extract sentences including any of the first two phrases in list

[2]For "employee" in the list (2), we further require that "defined/pension/retirement benefit(s)" do not follow "employee". For "personnel" or "specialist", we allow one to three words between the word from the list (1) and "personnel" or "specialist". For "labor" in the list (2), we further exclude the cases in which "atory" or "atories" follow "labor".

[3]For example, the fiscal year 2005 10-K filing of the company HEARUSA INC states that "If we are not able to attract and retain qualified audiologists, we will be less able to compete with networks of hearing aid retailers or with the independent audiologists who also sell hearing aids and our business may be adversely affected." The combination of the first two phrases in the keyword list (3) with the keyword lists (1) and (2) will fail to capture such disclosure.

(3) but are not related to skilled labor risk, we further exclude the hits if the noun following the phrases is "customer", "supplier", "client", "contract", "creditor", "investor", "business", "segment", "subscriber", "right" or all possible plural forms of these words to make sure that we mainly capture the discussions on attracting and retaining key employees. For all the adjective words in lists (1) and (3), we also exclude the hits that include the negative prefixes.[4]

To check the validity of our approach, we ex post randomly select 300 10-K files and manually verify whether the extracted sentences correctly identify the disclosure of risk related to skilled labor. The validation process shows that 1,340 of the 1,440 randomly selected sentences correctly identify the risk according to our definition, implying a success rate of 93.06% for our algorithm.

Finally, we define "Skilled Labor Risk" as the total number of sentences including the keywords related to skilled labor risk in all three 10-K items. In Figure 1, we present the time-series trends of Skilled Labor Risk in each fiscal year. The figure shows that the average intensity of the discussions on skilled labor risk increased substantially over time, from about one sentence in 1996 to five sentences in 2013. There is a large jump in the intensity of the skilled labor risk discussions in fiscal year 2005 when the SEC regulation required all firms to discuss risk factors in their 10-Ks. This suggests that the mandatory requirement of the discussion on risk factors prompts firms to explicitly acknowledge skilled labor risk. The summary statistics for Skilled Labor Risk are presented in Table 2.1. The sample firms on average spend about three sentences on skilled labor risk in their 10-Ks.

In Table 2.2, we present the ten SIC2 industries with highest (Panel A) and lowest (Panel B) skilled labor risk in fiscal year 2013 based on the employment-weighted average Skilled Labor Risk.[5] The results show that various service industries that heavily rely on human capital are among the industries with the highest skilled labor risk. Petroleum and coal products, paper products, wholesale and food industries are among the industries with the lowest skilled labor risk. The results in Table 2.2 are largely consistent with our prior about the differential reliance on skilled labor across industries. Furthermore, industries with high skilled labor risk are not limited to high-tech R&D-intensive industries. Our measure, applicable to all firms, can potential provide a more complete understanding of skilled labor risk in the economy. Finally, we find that the within-industry variation in Skilled Labor Risk is almost six times of the cross-industry variation, which is why we mostly focus on understanding the former in our analysis below.

[4]For example, we exclude the hits that contain "unskilled labor".

[5]To make sure that statistics in Table 2.2 is not driven by the small number of firms in each industry, we require the number of firms in each industry to be at least 20 to be included in this analysis.

2.3 Information Content of the Skilled Labor Risk Measure

In this section, we examine the information content of our skilled labor risk measure by examining its relation to probability of skilled labor turnover in the firm and various factors that affect the mobility and supply of skilled labor in the firm's headquarters region. We also address the potential concern that the variation in our measure reflects variation in firms' disclosure styles rather than true exposures to skilled labor risk.

We first examine whether firms with higher skilled labor risk tend to experience more frequent skilled labor turnover. Ideally, we'd like to examine the turnover of skilled labor in general. However, such data are not readily available for a large sample of firms. We thus provide evidence regarding the turnover of one group of key talents in the firm, CEO and other top four executives, as the information about them are readily available via the Execucomp and Capital IQ databases. Note that our algorithm described in Section 2 does not pick up discussions directly about executive turnovers, and thus the relation between *Skilled Labor Risk* and realized executive turnover is not mechanical. We relate *Skilled Labor Risk* in year t to executive turnovers in the firm in the past three years (including year t) and in the next three years. The results are reported in Table 2.3. We find that firms with more intense discussions about skilled labor risk in year t's 10-K tend to be those that have experienced executive turnovers in the recent past, and they are also more likely to experience executive turnovers in the near future. The results suggest that our skilled labor risk measure does respond to a firm's realized or potential failure of retaining key talents.

The results in Table 2.3 also suggest that a set of firm characteristics are related to firms' skilled labor risk. Appendix 2.A presents the definitions of all variables. Larger but younger firms tend to have higher skilled labor risk. Growth opportunities are also associated with higher skilled labor risk, no matter whether we measure growth opportunities by the market-to-book equity ratio, sales growth rate, R&D intensity, or capital investment. Firms with more volatile sales also tend to have higher skilled labor risk.

Next, we examine the relation of our skilled labor risk measure with regional forces that affect the mobility and supply of skilled labor.

2.3.1 Mobility of Skilled Labor

The mobility of skilled labor is closely related to their outside options, which are influenced by labor market competition as well as various state policies that restrain or facilitate skilled labor's ability to pursue their outside options.

Labor Market Competition

We expect a firm's exposure to skilled labor risk to increase when skilled labor's outside option set expands, that is, when the labor market competition for talents is more intense. To gauge the size of the labor market pool relevant for the competition of key talents, we consider both the industry dimension and the geography dimension. Are the desired skills in key talents industry-specific or general? How constrained is the mobility of skilled labor by geography? To answer these questions, for each firm we consider industry rivals and non-industry rivals with varying distances to the firm's headquarters as the potential set of outside options for key talents. To gauge the relevant size of locality, we use the headquarters address extracted from a firm's 10-K filings to determine the latitude and longitude of its location, and then use different mileage radius around the headquarters: within 50 miles, between 50 and 100 miles, between 100 and 200 miles, and outside 200 miles. "# of Industry Rivals (m mi radius)" counts the number of publicly traded firms in the same 2-digit SIC (SIC2) industry and within an m-mile radius from the firm's headquarters location.[6] Similarly, "# of Non-Industry-Rivals (m mi radius)" counts the number of publicly traded firms outside the firm's industry in an m-mile locality around the firm. Table 2.1 presents the summary statistics for the labor market competition measures.

In Table 2.4, we present the estimated relation between measures of labor market competition and firms' skilled labor risk. All the measures of labor market competition are scaled by their standard deviations to facilitate comparison of marginal effects across variables and across regressions. The results suggest that the outside option set most relevant to a firm's skilled labor consists of industry rivals located within a 50-mile radius of a firm's headquarters. Based on the estimates in column (1), a one-standard-deviation increase in the number of local rivals increases the firm's skilled labor risk by 19% (=0.58/3.01) relative to the sample mean. However, the number of distant industry rivals does not contribute to the firm's skilled labor risk, suggesting that the most relevant labor market pool for a firm's skilled labor tends to be in the commutable zone around the firm's headquarters. The number of firms outside the firm's industry, no matter local or distant, also does not contribute to the firm's skilled labor risk. These results suggest that the desired skills from skilled labor tend to be industry-specific rather than general across industries.

The estimates in columns (2)-(4) suggest that the pattern is robust to controlling for industry fixed effects, industry-state fixed effects and firm fixed effects. In addition, in Appendix 2.B we consider alternative industry classifications (SIC3, Fama-French 48, Hoberg-Phillips peer firms (Hoberg and Phillips (2010)) as well as alternative measures for local

[6] In untabulated tests, we also consider alternative industry classifications (SIC3, Fama-French 48, Hoberg-Phillips peer firms (Hoberg and Phillips (2010)) as well as alternative measures for local labor market competition. The results are robust to different industry classifications.

labor market competition. Overall, the results suggest that our skilled labor risk measure is robustly sensitive to local labor market competition.

State Non-Compete Agreements

Non-compete agreements prohibit employees from joining or starting rival companies and therefore restrict employees' outside options. If skilled labor risk is related to key employees' mobility, then we expect firms headquartered in states with stronger enforcements of the non-compete agreements to be less concerned about losing their key talents. Furthermore, a firm's skilled labor risk should also be less sensitive to the local labor market competition when the non-compete agreements are more strongly enforced at the state level.

Although the majority of states recognize various formats of non-compete agreements, the enforcement levels vary across states. The data on the enforcement index of non-compete agreements at the state level come from Garmaise (2011) and are available between 1994 and 2004. For years after 2004, we impute the enforcement index using the values in 2004.

Table 2.5 presents the results. In columns (1) and (2), we use the data from 1996 to 2004. The estimation in column (1) shows that firms' skilled labor risk is lower in states with stronger enforcement of the non-compete agreements. The estimates suggest that a one-standard-deviation increase in the enforcement index of non-compete agreements is associated with a 7.7% (= (-0.125*1.854)/3.01) decrease relative to the sample mean in a firm's skilled labor risk. In column (2), we examine the interaction effect between the non-compete agreements enforcement index and local labor market competition. The interaction effect is negative and significant, which suggests that a firm's skilled labor risk becomes less sensitive to the local labor market competition when the state-level enforcement of non-compete agreements is stronger. In column (3), we impute the non-compete enforcement index data after 2005 with the value in 2004 and estimate the specification in column (2) using the full sample and the results are similar.[7]

Residential Real Estate Transfer Tax

Residential real estate transfer taxes are taxes imposed by states, counties and municipalities on the transfer of the title of real property within the jurisdiction. Although these taxes are

[7]Another related state policy is the Inevitable Disclosure Doctrine (IDD), which is a legal doctrine adopted by a state court that can prevent a firm's former employee from working for a rival firm if this would "inevitable" lead the employee to disclose the firm's trade secrets to the rival. The IDD may further restrain the mobility of key talents beyond the effects of the non-compete agreement because it is applicable even if the employee does not sign a non-compete or non-disclosure agreement with the firm. However, there is no consensus in the current literature about the key state court rulings that led to material changes in the recognition of the IDD. For example, the court rulings on the IDD identified by Kahnke et al. (2008) ,Wiesner (2012), Klasa et al. (2016), and Flammer and Kacperczyk (2016) are not fully consistent with each other. We thus present only some preliminary results regarding the relation between the IDD adoption (rejection) and our skilled labor risk measure in Appendix 2.B.

not levied with the purpose of regulating skilled labor mobility, they could have an impact on it by affecting the cost of moving for skilled labor, who are likely home owners.

The data on the residential real estate transfer tax rate come from the Thomson Reuters Checkpoint and the Lincoln Institute of Land Policy, and are available for most of the states between 1996 and 2014.[8] If a state has both deed recording tax and mortgage recording tax, then we aggregate these two types of tax and calculate the transfer tax rate as the ratio of transfer taxes paid to the house value, assuming that the mortgage value is 80% of the house value. For the majority of the states, the transfer tax rate is independent of the house value. However, the transfer tax rate is progressive in Connecticut, Hawaii (since 2005), New Jersey, New York and Vermont. For these five states, we assume that the house value is $1 million and calculate the transfer tax rate. But the results are robust to other house value assumptions (e.g., $0.4 million or $0.8 million).

In Panel A of Table 2.6, we first confirm that transfer taxes indeed affect the mobility of households. We utilize the data from the Annual Social and Economic Supplement (ASEC) of the Current Population Survey (CPS) from 1997 to 2015. The data provides information on whether a person changed residence since the previous year. If a person moved, the reason for moving is also available in four categories: job, housing, family, and others. In all estimations, we focus on people who are household heads with age between 18 and 60 (i.e., the working age), and control for personal characteristics, state of residence conditions and year fixed effects. The standard errors are clustered by state.

The estimations in Panel A of Table 2.6 show that the probability of household moving decreases when the state and local transfer tax rate is higher. All dependent variables are scaled by their own sample means to facilitate comparison of effects across regressions. A one-percentage-point increase in the transfer tax rate is associated with an 9% decrease relative to the sample mean in the overall probability of moving. Among the four main reasons for moving, transfer tax has the largest effect on job-related moving (a 13% decrease in the probability relative to the sample mean). One stylized fact, which is also evident in Panel A, is that people with high education (college degrees or above) are more likely to have job-related moving. Column (3) shows that the effect of transfer tax on job-related moving for highly educated households doubles that for less educated households. If skilled labor are likely to be highly educated homeowners, then transfer tax could be a meaningful constraint on their mobility. Overall, the results in Panel A suggest that transfer taxes on residential housing transactions do affect the mobility of households and particularly the

[8]The data from the Lincoln Institute of Land Policy is available at: `https://www.lincolninst.edu/subcenters/significant-features-property-tax/Report_Real_Estate_Transfer_Charges.aspx`. We do not have the transfer tax rate information for Alabama, Arkansas, Washington D.C., Delaware, Georgia, Hawaii, Kansas, Nebraska, New Jersey, Nevada, Ohio, South Carolina, and South Dakota in 1996 and Georgia in 1999.

job-related mobility for highly educated people.

Given the effect of real estate transfer tax on household mobility, we expect firms headquartered in states with higher transfer tax rates on residential housing transactions to mention less about skilled labor risk in 10-Ks. The results in Panel B of Table 2.6 suggest that this is indeed the case. The estimation in column (1) shows that skilled labor risk is lower when the state transfer tax rate is higher. In particular, a one-standard-deviation increase in the transfer tax rate is associated with an 11.0% (-0.472*0.7/3.01) decrease in skilled labor risk relative to the sample mean. In column (2), we estimate the marginal effect of the transfer tax rate on the sensitivity of skilled labor risk to local labor market competition. The result suggests that skilled labor risk is less sensitive to local labor market competition for firms headquartered in states with higher transfer tax rates on residential housing transactions.

The transfer tax rates are stable over time. During our 18-year sample period that covers multiple economic recessions and expansions, only 13 states and the District of Columbia changed their transfer tax rates. In column (3) of Panel B we further control for state fixed effects to isolate the effect of changes in transfer tax rate on changes in firms' skilled labor risk. The results show that transfer tax rates are still negatively related to skilled labor risk, although we don't have enough power to identify a statistically significant effect. However, the interaction term between transfer tax rate and local labor market competition still has a negative and significant effect on skilled labor risk. In column (4), we use the 1997 transfer tax rates instead of the contemporaneous rates.[9] The magnitudes of the estimated effects are very similar to those in column (2), suggesting that the cross-state variation in the 1997 transfer tax rates already captures the bulk part of the variation in transfer tax rates that is relevant for skilled labor risk.

In Panel B we further control for the home ownership rate in a state for two reasons. First, Panel A of Table 2.7 suggests that home owners are significantly less likely to move, regardless of the reason for the move. Second, the state real estate transfer tax rate could be a function of the state's home ownership rate and we want to identify the effect of the tax policy beyond that of home ownership. The data on home ownership rate at the state level come from the United States Census Bureau. We find that the state home ownership rate is negatively and significantly related to firms' skilled labor risk, consistent with the finding in Panel A that home ownership decreases labor mobility.

Overall, the estimations in Tables 2.4-2.6 suggest that the firm-level skilled labor risk is related to key talents' mobility. Firms discuss such risk less intensively in annual reports when labor market competition is less intense and when state policies that intentionally or

[9]We do not use the 1996 transfer tax rates because there are several states for which we do not have information about the 1996 rates.

unintentionally restrain labor mobility are stronger.

2.3.2 Supply of Educated Labor

The risk of failing to attract and retain skilled labor should also depend on the supply of educated labor. We thus examine whether firms discuss risk related to skilled labor less intensively in 10-Ks when the educated labor supply increases. We use three measures for the supply of educated labor. The first two measures represent each firm's average distance to land-grant universities and colleges, which are major sources of supply for educated labor. In particular, for each firm we calculate the average distance between the firm's headquarters and the land-grant institutions in the U.S. and the average distance between the headquarters and the land-grant institutions in the headquarters states. The land-grant universities and colleges are identified using the classifications in 1862 and 1890 and there are 73 land-grant universities in total. The third measure for the supply of highly educated labor is the number of higher education institutions per one-million-population in each state. The number of higher education institution data come from the National Center for Education Statistics.

Table 2.7 presents the results. The estimations in columns (1) and (2) show that when a firm's average distance to land-grant universities and colleges increases, the firm is more concerned about the risk related to skilled labor. Based on the estimate in column (1), when the average distance to all land-grant universities and colleges in the U.S. increases by 100 miles, the firm's skilled labor risk increases by about 4% relative to the sample mean. Column (3) shows that the number of higher education institutions per one-million population in a state does not have additional power in explaining the firm-level skilled labor risk beyond the other determinants.[10]

A firm may endogenously choose the headquarter state based on its demands for highly educated labor. Therefore, the OLS estimations in Table 2.7 present the equilibrium effects and could be biased towards zero when estimating the supply effects of educated labor. The results, however, suggest that the supply side effects dominate the demand side effects.

2.3.3 Addressing Other Potential Concerns

Since our measure is based on corporate disclosures, it can be subject to the concern that corporate risk disclosures are driven more by disclosure regulations or firms' disclosure styles than firms' actual risk exposures. In the time series, there is a general trend for more disclosures in 10-Ks over time, driven by either the increase in mandated disclosures or

[10]We do not control natural logarithm of population at the state level since this variable is highly correlated with this measure for the educated labor supply.

investors' preference for more corporate disclosures over time. In the cross section, some firms may be more thorough in their disclosures than others, and may have longer discussions on every risk factor than other firms with similar risk exposures.

The fact that our measure is sensitive to various proxies of skilled labor mobility and supply suggests that it does have relevant information content.[11] Here we further address the concern in the following ways. First, in all regressions, we include year fixed effects, which means that our results essentially explain the variation in skilled labor risk across firms in a given year and mitigates the effect of the time trend in disclosure length on the results.

Second, we create a variable"*Non-Skilled-Labor-Related Discussion*" to capture the number of sentences unrelated to skilled labor risk in the relevant sections of a firm's 10-K. The length of a firm's general risk disclosure should reflect both time-series trend in disclosure and a firm's disclosure style. When the *Skilled Labor Risk* measure is positive, the value of this variable equals the total number of sentences in the sections where the firm mentions skilled labor risk minus the number of sentences related to skilled labor risk. When the *Skilled Labor Risk* measure is zero, the value of this variable equals the total number of sentences in "Business" and "Management Discussion & Analysis" for 10-Ks filed before December 2005 and the total number of sentences in "Business", "Risk Factors", and "Management Discussion & Analysis" for 10-Ks filed after December 2005.

Column (1) of Panel A, Table 2.8 represents the benchmark results. In column (2), we control for *Non-Skilled-Labor-Related Discussion* and find that our skilled labor risk measure is still sensitive to proxies of skilled labor mobility and supply, although the magnitude of the sensitivity becomes a bit smaller for all proxies but transfer tax. In column (3), we put *Non-Skilled-Labor-Related Discussion* as the dependent variable. We find that although the real estate transfer tax rate affects skilled labor risk, it has no effect on firms' general risk disclosures. Other proxies of skilled labor mobility and supply do affect firms' general risk disclosures, but the magnitudes of the effects are significantly smaller than those on skilled labor risk. These results suggest that *Skilled Labor Risk* is unlikely to be driven by the firm's disclosure style, and the bulk part of the information content in *Skilled Labor Risk* is not captured by the firm's general risk disclosures.

Third, a major disclosure regulation in our sample period is the Regulation S-K Item 305(c) in December 2005, which mandates the risk factor disclosure in 10-Ks and seems to have led to a jump in our measure of skilled labor risk (see Figure 1). Although this regulation is not about skilled labor risk per se, the mandates likely have prompted firms to

[11] Other studies that examine the information content of the "Risk Factor" section of 10-Ks also conclude that the disclosure is informative about the actual firm risk (see, e.g., Campbell et al. (2014), Hanley and Hoberg (2017)).

put more effort into acknowledging all possible risks. Thus, disclosures of skilled labor risk in firms' 10-Ks before December 1st 2005 were voluntary and less subject to the boilerplate-disclosure concern, but there could be underreporting of the risk. The disclosures of skilled labor risk after 2005 were less subject to underreporting but could be more subject to the boilerplate-disclosure concern.

In Panel B, we assess the impact of this regulation on the information content of our skilled labor risk measure. Column (1) reports the results for *Skilled Labor Risk* before the regulation and column (2) reports the results after the regulation. The skilled labor risk measure is standardized by the mean value of each period to facilitate comparison of marginal effects. We find that *Skilled Labor Risk* is sensitive to proxies of skilled labor mobility and supply in both sub-sample periods. However, the sensitivity is significantly lower in the post-regulation period, suggesting that the regulation makes the disclosure somewhat less informative about the underlying risk exposure.

Finally, we relate the skilled labor risk measure to standard notions of firm risk and risk management. The results in Panel C of Table 2.8 suggest that firms with higher skilled labor risk tend to have higher stock return volatility, higher idiosyncratic volatility, and higher equity beta. Those firms also tend to adopt more conservative financial management policies, holding more cash and having lower financial leverage. These results suggest that our skilled labor risk measure does pick up information about firm risk.

In Appendix 2.C we also discuss the relationship between our measure and several related measures in the literature, and the relative advantage of our measure.

2.4 Skilled Labor Risk and Compensation Policies

Compensation policy is probably the most relevant corporate policy for the attraction and retention of skilled labor. We examine the impact of skilled labor risk on both the level and structure of compensation policy for skilled labor. Theories suggest that the optimal compensation scheme in the presence of mobile talents should be sensitive to talents' time-varying outside options (e.g.,Oyer (2004) and Lustig et al. (2011)). When the agents' outside options are correlated with the firm's performance, the compensation contracts would give the agents a larger share of profits in the good states so that the participation constraints can be satisfied. For firms that more intensively discuss the attraction and retention of skilled labor as a risk factor, the outside option constraints of their skilled employees are more likely to be binding. Therefore, we expect that everything else equal, those firms ex ante offer their skilled labor higher compensation and structure the compensation more towards incentive pay.

2.4.1 Measures of Compensation Structure

Top Executives

The data for executive compensation policies come from both Execucomp. For all compensation structure measures, we compute the values for CEO and the average values for the executive team (all executives with reported compensation). Information about total compensation comes from item TDC1 in Execucomp. We use the fractions of incentive pay in total compensation to measure the incentive structure of executive compensation. Incentive compensation is defined as the sum of grant date value of stock, option and incentive plan awards.

Employees below the Top Rank

We take three approaches to examine the compensation policy for employees below the top rank. The first one is to construct the average ratio of incentive pay to total compensation for those employees in a similar fashion as we do for top executives. The second one is to examine the salaries offered to highly skilled labor under the H-1B visa program. The third approach is to examine firms' social investment in employee relations, particularly in employee compensation and benefits.

Under the first approach, the value of total incentive pay for employees below the top rank is proxied by the Black-Scholes value of stock option grants for all employees minus the value granted to top five executives. The data are available from ExecuComp for about 22% of firm-year observations in our sample between 1996 and 2005.[12] For the value of total compensation for non-executive employees, ideally we'd like to use the firm-level total labor compensation to estimate it. However, the Compustat item "Staff Expense-Total" ("XLR") is not widely available.[13] To address this issue, we rely on the wage data in the Quarterly Census of Employment and Wages (QCEW) from the Bureau of Labor Statistics, which covers 98% of U.S. jobs. The wage data in QCEW include salaries, bonuses, stock options, profit distributions and other benefits, and are comparable to the total staff expense in Compustat.[14] In particular, for firms that do not report the total staff expense, we estimate their labor compensation in a given year as the product of the firm's own employment and the average private-sector annual wage per employee in the firm's headquarters county

[12]For each option grant, ExecuComp reports the percentage of the grant to an executive in the total options granted to all employees during a fiscal year and such information allows us to estimate the value of option grants to non-executive employees. The estimate of the option grants to employees below the top rank equals to the total value of options granted to all employees minus the value of options granted to the top five executives. If the estimated value of option grants to non-executive employees is negative, then we set the value as zero.

[13]The "XLR" data are available for only about 14% of the firm-year observations with the broad-based employee stock option grant values.

[14]The definition is available at `https://www.bls.gov/cew/cewfaq.htm#Q16`.

and 3-digit NAICS industry in the year.[15] For firms that report total staff expenses, our estimated values and the reported values have comparable distributions and a correlation of 87%.[16] Also, there is on average two (median is one) publicly traded companies in a county-industry bin, accounting for 53% of the total private-sector employment in the bin, suggesting that the county-industry average wage is heavily influenced by the wage paid by local public companies. We then take out the portion that goes to top executives by subtracting the average executive total compensation times five, i.e., assuming five executives for all firms, from the estimated total labor compensation. The average incentive pay to total compensation ratio for non-executive employees equals the ratio of non-chief-executive broad-based stock option value to their total compensation. The correlation between the average incentive pay to total compensation ratio for employees below the top and that for top executives is around 39%.

To capture the compensation for skilled labor in another way, we use the information from labor condition applications (LCAs). A LCA is the supporting evidence for the petition for an H-1B visa filed by an employer who intends to hire a highly skilled labor that is not a U.S. citizen.[17] LCA data are available online at the Foreign Labor Certification Data Center for the U.S. government fiscal years (October to September) 2001 to 2016. For each LCA, we observe the application submission date, the proposed contract start date, the name and address of the employer, the occupational code of the foreign worker, whether the job is full time or not, the employer's proposed wage and the prevailing wage for the job, and the city and state of the employee's worksite. The prevailing wage is defined as the average wage paid to similarly employed workers in a specific occupation in the area of intended employment, which we will use as a control to absorb any occupation-geography specific shocks that affect the wage.[18] The advantage of the LCA wage data is that it is specifically about the compensation offered to highly skilled labor. We keep all cases of full-time job offers in an employer's headquarters state. We then merge the LCA data with Compustat information using the employers' names and headquarters address. In the end, we have 212,885 LCAs involving 2,812 public firms from (corporate) fiscal years 2000 to 2014. To

[15]To identify a firm's headquarters county, we first extract the 5-digit zip code of a firm's headquarters from its 10-K filing and then match the zip code to the county using the cross walk provided by the Missouri Census Data Center. For cases in which the zip code of a firm's headquarters crosses multiple counties, we calculate the average wage per employee in all counties.

[16]The distribution of the reported labor compensation and that of the estimated values are very similar up to the 99th percentile. The difference is mainly in the top 1 percentile, where the reported values tend to be larger than the estimated ones.

[17]According to the Department of Labor, the H-1B program is designed to help employers to hire non-immigrant aliens with highly specialized knowledge and the attainment of at least a bachelor's degree or its equivalent.

[18]The definition is available at `https://www.foreignlaborcert.doleta.gov/pwscreens.cfm`. The definition of "area of intended employment" at 20 CFR 656.3 states: Area of intended employment means the area within normal commuting distance of the place (address) of intended employment and is available at `http://www.flcdatacenter.com/skill.aspx`

mitigate the effects of outliers, the proposed wages and the prevailing wages are winsorized at 1% and 99% percentiles.

Our third approach is to look into firms' social investment score in the employee relations category. The information is from the MSCI database.[19] MSCI rates a firm's strength in employee relations in 13 dimensions with a rating of 0 (bad) or 1 (good) in each evaluated dimension.[20] "Total Strengths of Employee Relations" is defined as the average rating across all evaluated dimensions in the strengths of employee relations and is between 0 and 1. This measure is constructed so that the values are comparable across firms and over time.[21] We further single out four dimensions related to employee compensation and benefits: cash profit sharing, employee involvement (related to employee stock ownership plan), retirement benefits, and compensation and benefits. "Compensation & Benefits Related Strength" is the average score in these dimensions, ranging from 0 to 1.

2.4.2 Empirical Design and Results

To test the theoretical predictions, we face a challenge. If a compensation policy is truly effective at attracting and retaining key employees, then firms using such a policy should be less concerned about losing their key talents, leading to a lower value of *Skilled Labor Risk*. In equilibrium, such reverse causality would dampen the true effect of *Skilled Labor Risk* on compensation structure, making the estimated effects in OLS regressions biased towards zero. Indeed, regardless of the facet of the compensation policy, all the OLS estimates for the effect of *Skilled Labor Risk* reported in Tables 2.9-2.13 are close to zero and not consistently significant.

To overcome this challenge, we consider two plausible instruments for Skilled Labor Risk. The first one is the state real estate transfer tax rate in a firm's headquarters state in 1997. The results in Table 2.7 suggest that the 1997 transfer tax rate is strongly correlated with a firm's skilled labor risk. The historical housing transfer tax rates can be reasonably

[19]The database on CSR was originally created by KLD Research & Analytics, Inc. (KLD) in 1991. MSCI acquired KLD in 2010. The matching procedure between the CSR data in MCSI and Compustat is as follows. In the first step, we merge the MCSI data with Compustat using the 8-digit CUSIP, and then for the matched data we manually check whether the corporate names are matched. In the second step, for the MCSI data that cannot be matched to Compustat in the first step, we match them with Compustat using TICKER. Again, for the matched data, we manually check whether the corporate names are matched. Around 74% of firm-year observations in the MCSI database are matched to Compustat.

[20]The 13 dimensions are cash profit sharing, compensation & benefits, controversial sourcing, human capital development, employee involvement, employee relations, employee health & safety, non-layoff policy, retirement benefits, professional development, supply chain labor standards, union relations, and other strengths.

[21]In addition to the data on CSR strengths, MCSI also has data on CSR concerns. Therefore, an alternative measure is the difference between the total number of strengths and the total number of concerns in these four dimensions. However, as discussed in footnote 9 in Flammer and Ioannou (2016), recent research argues that the data on CSR strengths and concerns in MCSI lack convergent validity and, as a result, such methodology is questionable.

exogenous to corporate compensation policies for the following reasons. First, this is a policy directly relevant to residents rather than to businesses, and it is relevant to residents only when they buy or sell houses. Thus, firms are unlikely to sort into different states based on housing transfer tax rates. One may argue that firms could sort into states based on other permanent state characteristics that are correlated with the historical transfer tax rates. We thus examine a kitchen-sink list of firm characteristics that include and go beyond the determinants that have been studied in the executive compensation literature. The results in Appendix 2.D suggests that overall there are no significant differences in firm characteristics between high and low transfer tax states. The exception includes the ratio of intangible assets to total assets and the CEO-Chairman duality, which we control in the 2SLS estimations. Second, being very stable over time, transfer tax rates, particularly the historical rates, are unlikely to be correlated with fluctuations in state economic or fiscal conditions, which may be correlated with firms' profitability and growth and thus compensation structure.

The second instrument is a measure of local home equity shock. Similar to the identification strategy used in Corradin and Popov (2015) and Chetty et al. (2017), we construct "*Home Equity Shock*" to be the yearly percentage change in the national average house price index scaled by the local (MSA-level) topological elasticity of housing supply from Saiz (2010). The idea behind this instrument is that it captures an exogenous change in household home equity in an MSA, which can affect home owners' mobility and thus firms' skilled labor risk. An increase in the nation-wide demand for housing will increase the national average house price, and the effect is amplified in areas with inelastic housing supply due to land availability. An increase (decrease) in home equity can facilitate (decrease) skilled labor mobility (see, e.g., Corradin and Popov (2015), Goetz (2013), and Struyven (2014)). A limitation of *Home Equity Shock* is that our skilled labor risk measure could be insensitive to decreased labor mobility due to negative shocks to home equity during the recent housing bust. This is because once a firm starts to disclose skilled labor risk in its 10Ks in the post SEC Regulation S-K Item 305(c) period (i.e., after 2005), the value of skilled labor risk measure is unlikely to decrease over time (see details in Appendix 2.E). This problem can cause this instrument to be invalid in periods with national house price declines (i.e., years 2008-2011). Thus, we can only use this instrument in periods with positive home equity shocks.

Overall, we think that both instruments are reasonably exogenous to firms' compensation policies for skilled labor and key talents. Although neither instrument is perfect, they do represent different sources of variation in skilled labor mobility and thus firms' skilled labor risk. Thus, if both instruments yield consistent results, then this will give us confidence that our identification strategy is sensible.

Table 2.9 reports the OLS and the 2SLS estimates for the relation between *Skilled Labor*

Risk and executive compensation policies using the historical state real estate transfer tax rate as the instrument. The 2SLS estimation suggests that firms with higher skilled labor risk due to a lower state-level historical real estate transfer tax rate do use more incentive pay in executive compensation contracts, consistent with the theoretical predictions. The estimated effects are not only statistically significant but also economically larger than the OLS estimates. For example, for the executive team, a one-standard-deviation increase in *Skilled Labor Risk* would increase the average fraction of incentive pay in total executive compensation by about 27% relative to the sample mean. Table 2.10 reports the 2SLS estimates for the relation between *Skilled Labor Risk* and executive compensation policies using the home equity shock as the instrument. The estimates are consistent with those in Table 2.9, and even the magnitudes are comparable. Firms facing higher skilled labor risk due to larger positive home equity shocks in the region do use less cash pay and more incentive pay.

Table 2.11 reports the OLS and 2SLS estimates for the relation between *Skilled Labor Risk* and the compensation policy for employees below the top rank. We see a similar pattern as for top executive compensation. Firms with higher skilled labor risk tend to use more incentive pay for non-chief-executive employees as well. The sensitivity of incentive pay to skilled labor risk is even larger for employees below the top rank than for top executives. The estimation in column (2) suggests that a one-standard-deviation increase in *Skilled Labor Risk* would increase the average fraction of incentive pay in total pay for employees below the top rank by about 53% relative to the sample mean.

On the compensation level, skilled labor risk has no significant effect for top executives, but for employees below the top rank the effect is positive and significant.[22] The estimates in Table 2.11 suggest that a one-standard-deviation increase in skilled labor risk increases employee total compensation by about 12-21%. For the analysis using the salaries offered to highly skilled labor under the H-1B visa program, we cannot use the state real estate transfer tax as the instrument, which offers primarily cross-state variation. This is because job offers under the H-1B visa program are highly concentrated in a few states. There are five states that account for 70% of the LCAs: CA (34.4%), WA (13.6%), NY (10.7%), TX (5.7%), and MA (5.6%). Therefore, we do not have enough cross-state variation to make the first instrument powerful. Fortunately, we still have substantial cross-MSA variation even within

[22]For the compensation level tests using the home equity shock as the instrument, we scale the compensation level by the average Regional Price Parities (RPP) from the Bureau of Economic Analysis (BEA). This is because we find that the topological elasticity of housing supply is negatively correlated with the average house price in an MSA and thus could be correlated with compensation level through its correlation with the average cost of living in the area rather than its effect on labor mobility. According to BEA, Regional Price Parities (RPPs) measure the differences in the price levels of goods and services across states and metropolitan areas for a given year. RPPs are expressed as a percentage of the overall national price level for each year. The data is available for years 2008-2014. We compute the average RPP for an area and use it to scale the level of executive compensation.

the major H-1B hire states to utilize the home equity shock as an instrument. The estimates in Table 2.12 suggest that firms facing higher skilled labor ex ante offer significantly higher wages in order to attract highly skilled labor. A one-standard-deviation increase in skilled labor risk (4.1 in this sample) increases H-1B workers' salaries by about 23%. The effects on both pay level and pay structure are larger for employees below the top rank than for top executives, suggesting that our measure is more about the mobility of skilled labor in general than that of top executives.

Table 2.13 reports the OLS and 2SLS estimates for the relation between *Skilled Labor Risk* and firms' strength in employee relations. The results in Panel A suggest that skilled labor risk has a positive and weakly significant effect on the firm's strength in employee relations. In Panel B, we compare and contrast the strength in compensation and benefits related dimensions and that in other dimensions of employee relations. The results suggest that the positive relation between skilled labor risk and firms' investment in employee relations mainly lies in compensation and benefits related dimensions. Firms with higher skilled labor risk tend to grand employees better compensation and benefits packages. Note that the strength in compensation and benefits is not just about the level, as several dimensions within this category is about providing incentives to employees via profit sharing plans and employee stock ownership plans. But skilled labor risk does not explain firms' investment in other dimensions of employee relations.

2.5 Conclusion

Skilled labor has become increasingly important for corporations. The reliance on skilled labor also exposes firms to skilled labor risk, which we define as the risk of failing to attract and retain skilled labor. We create a measure of firms' exposures to skilled labor risk based on the intensity of firms' discussions on this risk in their 10-K filings. We find that this measure can effectively capture firm risk due to skilled labor mobility and short supply. Firms discuss more about skilled labor risk in their 10-Ks when they face more local labor market competition, or when their headquarters states have policies that directly or indirectly put less restrictions on the mobility of skilled labor, or when they have worse access to the supply of highly educated labor.

Given the information content of our skilled labor risk measure, we believe that it can shed light on the nature of outside options and mobility of skilled labor because for firms that more intensively discuss the retention of skilled labor as a risk factor, the participation constraints of their key employees are more likely to be binding. Our findings suggest that skilled labor's outside option set is industry-specific, which means that the desired skills and talents are industry-specific rather than general. The outside option set is local, mostly

in a 50-mile radius around the firm's headquarters, suggesting that skilled labor are not very mobile geographically. Our results do not necessarily mean that skilled labor are not demanded across geographic areas. The reason could come from the supply side. People may have various reasons to prefer not to move.[23] One reason for skilled labor not being very mobile geographically could be that they are likely home owners and Census survey data show that home owners are significantly less likely to move than non-home owners. The local nature of skilled labor mobility suggests that local and state level policies that affect household mobility can have a large influence on skilled labor risk in local firms and externalities on the local economy.

Compensation policy is perhaps the policy that is most sensitive to skilled labor risk. We find that firms do adjust compensation contract for both top executives and employees below the top rank when facing skilled labor risk. In particular, we find that firms adjust compensation towards more incentive pay when they face higher skilled labor risk, consistent with recent theories on optimal compensation when key talents are mobile. In addition, firms with higher skilled labor risk ex ante pay higher compensation to skilled labor, although the effect on pay level is smaller than the effect on pay structure. Analysis on firms' investment in strengthening employee relations also suggests that compensation and benefits related strength is most relevant for talent retention.

Our study suggests that skilled labor risk is pervasive in today's economy, not just a problem of high-tech companies. Yet more needs to be known about firms' exposures to such risk, particularly the vast majority of firms in traditional low-tech industries. Our study suggests that compensation policies is an important policy addressing firms' skilled labor risk. Future studies that shed light on other effective corporate policies to help firms mitigate skilled labor risk and the general equilibrium effects of state policies that affect labor mobility and firms' skilled labor risk will be very fruitful.

[23]The Current Population Surveys (CPS) in the U.S. suggest that on average only about 13% of the population move (i.e., change residence) in a year, and majority of the moves are within-state moves.

Figure 2.1: Trends of Skilled Labor Risk

This figure presents the time-series trend of the Skilled Labor Risk measure. Each dot in the plot represents the average of Skilled Labor Risk in each fiscal year.

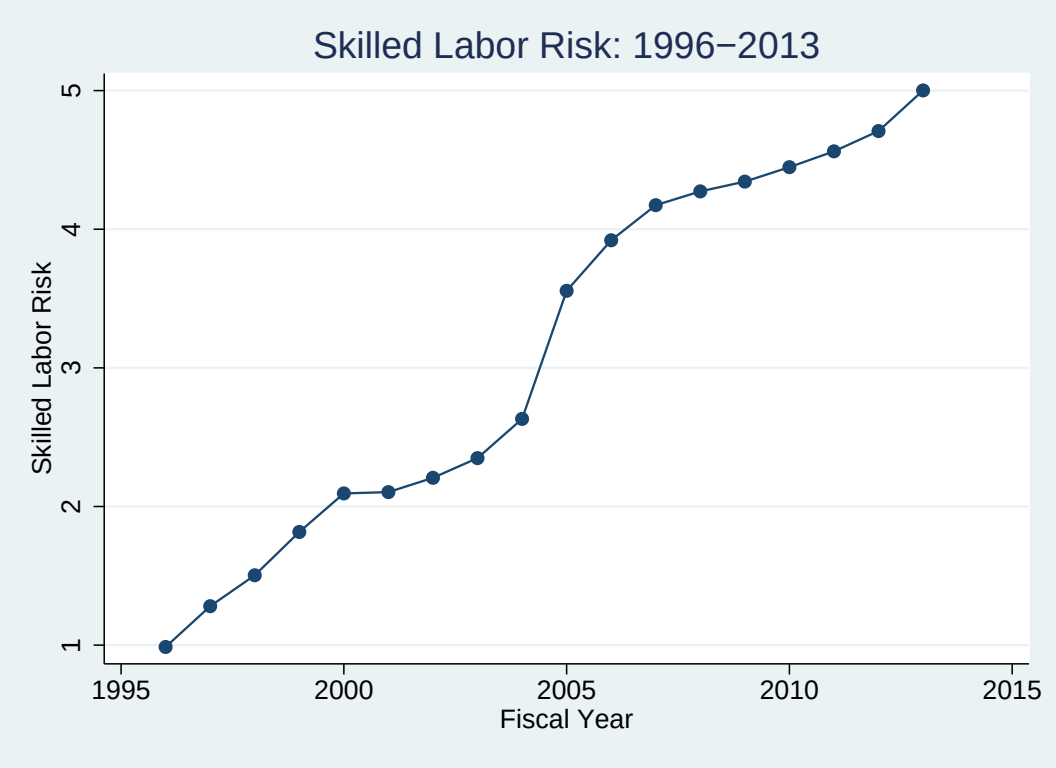


Table 2.1: Summary Statistics

This table reports the summary statistics for the firm-year and state-year level variables used in the paper. Firm characteristics and variables related to top executive and non-chief-executive employee compensation are winsorized at the 1% and 99% percentiles to mitigate the effects of outliers. The summary statistics for cash holding and book and market leverage are based on the sample that excludes firms in financial (SIC $\geq$ 6000 & SIC $\leq$ 6999)and utility (SIC $\geq$ 4900 & SIC $\leq$ 4999) industries. All variable definitions and data sources are available in Appendix A.

	Panel A: Firm-Year Level Variables					
	N	Mean	P25	Median	P75	Std. Dev.
Skilled Labor Risk and Determinants						
Skilled Labor Risk	109,958	3.012	0.000	2.000	5.000	3.571
# of SIC2 Rivals (50 mi radius)	106,238	17.881	1.000	6.000	22.000	27.733
# of SIC2 Rivals (50-100 mi radius)	106,238	6.759	0.000	1.000	7.000	13.118
# of SIC2 Rivals (100-200 mi radius)	106,238	15.182	1.000	4.000	16.000	24.430
# of SIC2 Rivals (Outside 200 mi radius)	106,238	282.422	82.000	220.000	450.000	234.272
# of Non-SIC2-Rivals (50 mi radius)	106,238	239.037	47.000	175.000	321.000	248.765
# of Non-SIC2-Rivals (50-100 mi radius)	106,238	116.465	13.000	46.000	170.000	165.829
# of Non-SIC2-Rivals (100-200 mi radius)	106,238	257.235	52.000	135.000	418.000	271.990
# of Non-SIC2-Rivals (Outside 200 mi radius)	106,238	5709.105	4791.000	5624.000	6713.000	1134.882
Distance to Land-Grant U.(100 Miles)	106,100	11.598	9.171	10.483	12.849	3.593
Distance to In-State Land-Grant U.(100 Miles)	106,100	1.263	0.645	1.134	1.739	0.807
Compensation and Executive Characteristics						
CEO Compensation ($000)	29,774	2528.317	730.528	1480.377	3045.588	3043.877
Avg. Executive Compensation($000)	30,590	1239.555	431.494	779.788	1476.441	1373.898
CEO Incentive Pay/Total Pay	29,742	0.552	0.362	0.623	0.793	0.292
Avg. Executive Incentive Pay/Total Pay	30,587	0.496	0.327	0.531	0.687	0.239
CEO Age	31,736	55.440	50.000	55.000	60.000	7.583
CEO Tenure	29,961	7.151	2.000	5.000	10.000	7.303
Execu.Turnover in Past 3 Yr	68,464	0.621	0.000	1.000	1.000	0.485
Execu.Turnover in Next 3 Yr	68,464	0.577	0.000	1.000	1.000	0.494
Non-chief-executive Employee Compensation ($000)	10,360	57.658	37.614	50.789	69.182	35.617
Non-chief-executive Employee Incentive Pay/Total Pay	10,360	0.123	0.013	0.040	0.140	0.189
Salary for Skilled Labor	9,875	86.856	69.615	83.740	100.530	26.603
Total Strengths of Employee Relations	28,015	0.062	0.000	0.000	0.000	0.133
Compensation&Benefits-Related Strengths of Employee Relations	24,427	0.085	0.000	0.000	0.000	0.200
Other Strengths of Employee Relations	28,015	0.047	0.000	0.000	0.000	0.141

	Panel A: Firm-Year Level Variables (Continued)					
	N	Mean	P25	Median	P75	Std. Dev.
Firm Characteristics						
Log(AT)	107,992	4.771	3.215	4.966	6.496	2.571
Log(1+Firm Age)	109,958	2.804	2.197	2.890	3.466	0.943
ROA	104,650	-0.145	-0.006	0.072	0.142	1.045
Market to Book	91,895	2.061	1.031	1.317	2.104	2.210
Sales Growth	101,504	0.200	-0.063	0.049	0.209	0.830
R&D	103,897	0.265	0.000	0.000	0.041	1.358
Capex	102,152	0.048	0.008	0.027	0.060	0.065
Tangibility	104,659	0.226	0.033	0.131	0.343	0.244
Intangible Assets	101,240	0.121	0.000	0.026	0.178	0.181
Sales Vol.	103,503	0.229	0.044	0.121	0.265	0.340
Cash Holding (%)	81,912	21.759	2.828	11.066	32.564	25.085
Book Leverage (%)	71,211	27.785	0.956	22.204	46.897	26.938
Market Leverage (%)	77,875	21.460	0.438	11.665	34.241	25.202

	Panel B: State-Year Level Variables					
	N	Mean	P25	Median	P75	Std. Dev.
Non-Compete	963	4.348	3.000	5.000	6.000	1.854
Real Estate Transfer Tax (%)	949	0.505	0.000	0.230	0.532	0.698
Employment Rate	963	0.607	0.557	0.590	0.628	0.112
Log(Income Per Cap.)	963	2.861	2.751	2.837	2.963	0.166
Log(Population)	963	1.261	0.460	1.402	1.887	1.032
State Colleges Per Cap $\times 10^6$	963	11.977	8.192	10.498	13.404	6.482

Table 2.2: Industry Distribution of Skilled Labor Risk

This table reports the top 10 two-digit SIC industries (Panel A) and the bottom 10 industries (Panel B) based on the employment-weighted average Skilled Labor Risk in the most recent fiscal year in our sample (year 2013).

Panel A: Industries with Highest Skilled Labor Risk		
SIC2	Industry Description	Skilled Labor Risk
87	Engineering, accounting, research, management, and related services	10.14
82	Educational services	10.00
80	Health services	9.90
73	Business Services	8.43
65	Real estate	7.03
62	Security and commodity brokers, dealers, exchanges, and services	6.98
16	Heavy construction other than buildings construction–contractors	6.69
79	Amusement and recreation services	6.26
39	Miscellaneous manufacturing industries	5.99
36	Electronic and other electric equipment	5.61
Panel B: Industries with Lowest Skilled Labor Risk		
SIC2	Industry Description	Skilled Labor Risk
29	Petroleum and coal products	0.92
26	Paper and allied products	1.42
51	Wholesale trade - nondurable goods	1.46
20	Food and kindred products	1.91
42	Motor freight transportation and warehousing	1.95
45	Transportation by air	2.01
25	Furniture and fixtures	2.11
49	Electric, gas, and sanitary services	2.13
54	Food stores	2.14
48	Communications	2.24

Table 2.3: Skilled Labor Risk and Executive Team Turnover

This table reports the relations between a firm's skilled labor risk and the executive team turnover in the past and next three years. The dependent variables in columns (1) and (2) are *Skilled Labor Risk* and *Execu.Turnover in Next 3 Yr*, respectively. *Execu.Turnover in Past 3 Yr* is a dummy variable equal to one if a firm experiences at least one executive departure in the past three years (including current year) and zero otherwise. *Execu.Turnover in Next 3 Yr* is a dummy variable equal to one if a firm experiences at least one executive departure in the next three years and zero otherwise. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	Skilled Labor Risk	Execu.Turnover in Next 3 Yr
	(1)	(2)
Execu.Turnover in Past 3 Yr	0.284***	
	[0.049]	
Skilled Labor Risk		0.004***
		[0.001]
Log(Assets)	0.150***	0.064***
	[0.018]	[0.002]
Log(1+FirmAge)	-0.651***	0.013***
	[0.043]	[0.004]
ROA	-0.082	-0.010
	[0.098]	[0.010]
Market to Book	0.055***	0.016***
	[0.015]	[0.001]
Sales Growth	0.186***	-0.005**
	[0.021]	[0.002]
R&D	0.185***	-0.001
	[0.023]	[0.002]
R&D Missing	-0.405***	-0.039***
	[0.085]	[0.007]
Capex	4.035***	0.157***
	[0.443]	[0.052]
Tangibility	-2.206***	-0.014
	[0.199]	[0.020]
Intangible Assets	-0.481**	-0.029*
	[0.194]	[0.016]
Sales Vol.	0.400***	0.010
	[0.096]	[0.010]
Employment Rate	0.785	0.133**
	[0.626]	[0.054]
Log(Income Per Cap.)	-0.183	-0.074***
	[0.249]	[0.024]
Log(Population)	0.320***	0.003
	[0.042]	[0.004]
Ind. FE, Yr FE	Y	Y
Adj. R^2	0.315	0.317
N	68464	68464

Table 2.4: Skilled Labor Risk and Local Labor Market Competition

This table reports the effect of labor market competition on a firm's skilled labor risk using industry classifications based on the 2-digit SIC industries. To facilitate comparisons, all variables for labor market competition are standardized by their own standard deviations. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
# of SIC2 Rivals (50 mi radius)	0.583***	0.376***	0.311***	0.187**
	[0.044]	[0.046]	[0.068]	[0.073]
# of SIC2 Rivals (50-100 mi radius)	-0.101*	-0.061	0.075	-0.017
	[0.056]	[0.051]	[0.070]	[0.070]
# of SIC2 Rivals (100-200 mi radius)	-0.273***	-0.177***	-0.024	-0.067
	[0.052]	[0.050]	[0.083]	[0.082]
# of SIC2 Rivals (Outside 200 mi radius)	0.042	-0.238**	-0.289**	-0.019
	[0.080]	[0.106]	[0.117]	[0.078]
# of Non-SIC2-Rivals (50 mi radius)	-0.512***	-0.495***	-0.333***	-0.128
	[0.079]	[0.076]	[0.087]	[0.081]
# of Non-SIC2-Rivals (50-100 mi radius)	-0.267***	-0.239***	-0.244***	-0.065
	[0.063]	[0.059]	[0.070]	[0.075]
# of Non-SIC2-Rivals (100-200 mi radius)	-0.279***	-0.337***	-0.207**	-0.043
	[0.087]	[0.082]	[0.097]	[0.091]
# of Non-SIC2-Rivals (Outside 200 mi radius)	-1.135***	-1.077***	-1.028***	-0.104
	[0.320]	[0.304]	[0.292]	[0.179]
Log(Assets)	0.041***	0.156***	0.172***	0.374***
	[0.016]	[0.017]	[0.018]	[0.040]
Log(1+FirmAge)	-0.529***	-0.595***	-0.555***	-0.094
	[0.042]	[0.041]	[0.041]	[0.113]
ROA	0.252***	-0.022	-0.015	-0.291***
	[0.090]	[0.088]	[0.085]	[0.075]
Market to Book	0.077***	0.046***	0.045***	0.040***
	[0.016]	[0.013]	[0.013]	[0.011]
Sales Growth	0.143***	0.165***	0.158***	0.075***
	[0.021]	[0.020]	[0.020]	[0.016]
R&D	0.169***	0.191***	0.152***	0.034**
	[0.022]	[0.022]	[0.022]	[0.017]
R&D Missing	-0.498***	-0.367***	-0.273***	-0.005
	[0.070]	[0.081]	[0.087]	[0.108]
Capex	5.579***	3.817***	2.776***	0.715**
	[0.442]	[0.407]	[0.395]	[0.294]
Tangibility	-1.633***	-2.138***	-1.904***	0.095
	[0.146]	[0.187]	[0.197]	[0.208]
Intangible Assets	1.393***	-0.322*	-0.116	0.461**
	[0.175]	[0.185]	[0.187]	[0.195]
Sales Vol.	0.794***	0.391***	0.374***	0.027
	[0.093]	[0.088]	[0.087]	[0.091]
Employment Rate	-1.048	-1.492**	-2.083	-1.145
	[0.705]	[0.661]	[2.848]	[1.097]
Log(Income Per Cap.)	1.793***	1.539***	2.626**	1.013*
	[0.398]	[0.371]	[1.040]	[0.603]
Log(Population)	0.182***	0.170***	-0.033	-0.066
	[0.047]	[0.043]	[0.745]	[0.099]
Yr FE	Y	Y	Y	Y
Ind. FE	N	Y	N	N
Ind. × State FE	N	N	Y	N
Firm FE	N	N	N	Y
Adj. R^2	0.258	0.325	0.399	0.756
N	71976	71976	71976	71976

Table 2.5: The Effect of the Non-compete Agreements

This table reports the effect of non-compete agreements enforcement in a firm's headquarters state on the firm's skilled labor risk and the sensitivity of skilled labor risk to local labor market competition. # of SIC2 Rivals (50 mi radius) is standardized by its standard deviation. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	Before 2005	Before 2005	1996-2013
	(1)	(2)	(3)
Non-Compete	-0.125***	-0.088***	-0.092***
	[0.014]	[0.015]	[0.016]
# of SIC2 Rivals (50 mi radius)	0.260***	0.343***	0.371***
	[0.045]	[0.052]	[0.050]
# of SIC2 Rivals (50 mi radius)*Non-Compete		-0.069***	-0.080***
		[0.016]	[0.016]
Log(Assets)	0.140***	0.138***	0.162***
	[0.016]	[0.016]	[0.017]
Log(1+FirmAge)	-0.591***	-0.585***	-0.601***
	[0.041]	[0.041]	[0.041]
ROA	-0.124	-0.122	-0.045
	[0.108]	[0.107]	[0.087]
Market to Book	0.072***	0.070***	0.044***
	[0.013]	[0.013]	[0.013]
Sales Growth	0.179***	0.178***	0.165***
	[0.024]	[0.024]	[0.020]
R&D	0.157***	0.157***	0.188***
	[0.026]	[0.026]	[0.023]
R&D Missing	-0.398***	-0.377***	-0.353***
	[0.079]	[0.079]	[0.081]
Capex	3.050***	3.055***	3.758***
	[0.405]	[0.404]	[0.407]
Tangibility	-1.740***	-1.748***	-2.097***
	[0.169]	[0.170]	[0.187]
Intangible Assets	-0.316*	-0.312*	-0.303
	[0.189]	[0.189]	[0.185]
Sales Vol.	0.514***	0.534***	0.395***
	[0.095]	[0.095]	[0.088]
Employment Rate	1.557***	1.051*	0.746
	[0.549]	[0.546]	[0.629]
Log(Income Per Cap.)	-1.103***	-0.491*	-0.499*
	[0.250]	[0.262]	[0.263]
Log(Population)	0.125***	0.086**	0.063
	[0.042]	[0.042]	[0.043]
Ind. FE & Yr FE	Y	Y	Y
Adj. R^2	0.293	0.295	0.326
N	35848	35848	71976

Table 2.6: Real Estate Transfer Tax and Labor Mobility

This table reports the effect of state transfer tax rate on residential housing transactions on labor mobility and Skilled Labor Risk. Panel A uses the data from the Annual Social and Economic Supplement (ASEC) of the Current Population Survey (CPS) and presents the estimated effects of the state transfer tax rate on households' moving decisions. The dependent variables in Panel A are all scaled by their own sample means. Panel B presents the estimated effect of the house transfer tax rate in a firm's headquarters state on the firm's skilled labor risk and the sensitivity of skilled labor risk to local labor market competition. # of SIC2 Rivals (50 mi radius) is standardized by its standard deviation. Standard errors in parentheses are robust and clustered at the state level in Panel A and at the firm level in Panel B. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	Panel A: Real Estate Transfer Tax and Household Mobility					
	All Move	Job	Job	Family	Housing	Other
	(1)	(2)	(3)	(4)	(5)	(6)
Real Estate Transfer Tax	-0.089**	-0.130**	-0.073	-0.072*	-0.085**	-0.102**
	[0.040]	[0.062]	[0.064]	[0.042]	[0.032]	[0.045]
Real Estate Transfer Tax*College Degree or Above			-0.166***			
			[0.050]			
Age	-0.042***	-0.043***	-0.043***	-0.048***	-0.037***	-0.047***
	[0.001]	[0.002]	[0.002]	[0.001]	[0.001]	[0.002]
Female	0.015**	-0.172***	-0.171***	0.093***	0.039***	-0.118***
	[0.006]	[0.016]	[0.015]	[0.012]	[0.008]	[0.021]
White	0.022	0.158*	0.155*	0.101*	-0.034	-0.050
	[0.047]	[0.084]	[0.084]	[0.056]	[0.045]	[0.077]
Black	-0.136***	-0.309***	-0.320***	-0.110*	-0.022	-0.386***
	[0.049]	[0.091]	[0.091]	[0.061]	[0.053]	[0.079]
Asian	-0.079***	0.066	0.064	-0.238***	-0.076*	0.114*
	[0.028]	[0.086]	[0.088]	[0.058]	[0.044]	[0.058]
Married	-0.143***	0.483***	0.483***	-0.465***	-0.101***	-0.216***
	[0.010]	[0.035]	[0.035]	[0.027]	[0.012]	[0.027]
Presence of Child	-0.311***	-0.562***	-0.564***	-0.286***	-0.131***	-0.803***
	[0.008]	[0.025]	[0.024]	[0.017]	[0.011]	[0.025]
College Degree or Above	0.109***	0.965***	1.062***	-0.138***	-0.041***	0.320***
	[0.008]	[0.042]	[0.050]	[0.016]	[0.011]	[0.022]
Log(Total Personal Income)	0.009***	0.004	0.004	0.007***	0.013***	-0.002
	[0.001]	[0.004]	[0.004]	[0.002]	[0.002]	[0.004]
Home Owner	-1.200***	-1.754***	-1.754***	-1.205***	-0.964***	-1.574***
	[0.072]	[0.112]	[0.112]	[0.080]	[0.063]	[0.096]
Employment Rate	-0.153	0.167	0.249	-0.351*	-0.238	-0.095
	[0.236]	[0.445]	[0.430]	[0.204]	[0.195]	[0.320]
Log(Income Per Cap.)	-0.432***	-0.848***	-0.866***	-0.647***	-0.155	-0.632***
	[0.141]	[0.297]	[0.294]	[0.162]	[0.142]	[0.191]
Log(Population)	-0.004	0.063	0.065	-0.019	-0.020	0.018
	[0.020]	[0.050]	[0.050]	[0.025]	[0.015]	[0.026]
Yr. FE	Y	Y	Y	Y	Y	Y
Adj. R^2	0.125	0.020	0.020	0.038	0.040	0.025
N	1002676	1002676	1002676	1002676	1002676	1002676

	Panel B: Real Estate Transfer Tax and Skilled Labor Risk			
	(1)	(2)	(3)	(4)
Real Estate Transfer Tax	-0.472***	-0.257***	-0.469	
	[0.055]	[0.062]	[0.295]	
Real Estate Transfer Tax*				
# of SIC2 Rivals (50 mi radius)		-0.246***	-0.128***	
		[0.040]	[0.042]	
Real Estate Transfer Tax (Yr 1997)				-0.243***
				[0.065]
Real Estate Transfer Tax (Yr 1997)*				
# of SIC2 Rivals (50 mi radius)				-0.237***
				[0.040]
# of SIC2 Rivals (50 mi radius)	0.233***	0.388***	0.340***	0.372***
	[0.043]	[0.049]	[0.051]	[0.049]
Non-Compete	-0.042**	-0.041**	-0.076	-0.042**
	[0.017]	[0.017]	[0.088]	[0.018]
Log(Assets)	0.162***	0.160***	0.160***	0.160***
	[0.017]	[0.017]	[0.017]	[0.017]
Log(1+FirmAge)	-0.594***	-0.583***	-0.529***	-0.583***
	[0.041]	[0.041]	[0.040]	[0.040]
ROA	-0.046	-0.036	-0.006	-0.035
	[0.088]	[0.088]	[0.086]	[0.087]
Market to Book	0.045***	0.044***	0.038***	0.044***
	[0.013]	[0.014]	[0.013]	[0.013]
Sales Growth	0.169***	0.172***	0.166***	0.170***
	[0.020]	[0.020]	[0.020]	[0.020]
R&D	0.188***	0.185***	0.178***	0.186***
	[0.023]	[0.023]	[0.022]	[0.022]
R&D Missing	-0.341***	-0.299***	-0.250***	-0.310***
	[0.081]	[0.082]	[0.081]	[0.081]
Capex	3.694***	3.697***	3.478***	3.706***
	[0.410]	[0.409]	[0.404]	[0.405]
Tangibility	-2.130***	-2.110***	-2.013***	-2.108***
	[0.187]	[0.188]	[0.187]	[0.186]
Intangible Assets	-0.280	-0.244	-0.153	-0.251
	[0.186]	[0.186]	[0.185]	[0.185]
Sales Vol.	0.363***	0.376***	0.394***	0.366***
	[0.088]	[0.088]	[0.087]	[0.087]
Employment Rate	-0.928	-1.280*	-2.098	-1.154*
	[0.648]	[0.660]	[2.761]	[0.655]
Log(Income Per Cap.)	-0.051	-0.254	2.465**	-0.464
	[0.291]	[0.291]	[1.045]	[0.285]
Log(Population)	-0.045	-0.094*	0.219	-0.075
	[0.048]	[0.048]	[0.731]	[0.048]
Home Ownership	-0.039***	-0.044***	0.013	-0.045***
	[0.007]	[0.006]	[0.015]	[0.007]
Ind. FE & Yr FE	Y	Y	Y	Y
State FE	N	N	Y	N
Adj. R^2	0.328	0.331	0.342	0.331
N	71334	71334	71334	71975

Table 2.7: Supply of Educated Labor

This table reports the estimated effect of a firm's access to the supply of educated labor on the skilled labor risk. We use a firm's average distance to land-grant universities and colleges within the headquarters state or across all states in the U.S. and the number of higher education institutions per one-million-population in the headquarters state to measure the access to educated labor. # of SIC2 Rivals (50 mi radius) is standardized by its standard deviation. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
Distance to Land-Grant U.	0.118***		
	[0.011]		
Distance to In-State Land-Grant U.		0.217***	
		[0.046]	
State Colleges Per Cap			-0.005
			[0.009]
# of SIC2 Rivals (50 mi radius)	0.231***	0.290***	0.271***
	[0.042]	[0.042]	[0.042]
Non-Compete	-0.023	-0.076***	-0.103***
	[0.016]	[0.015]	[0.015]
Real Estate Transfer Tax	-0.259***	-0.389***	-0.353***
	[0.050]	[0.051]	[0.053]
Log(Assets)	0.165***	0.163***	0.163***
	[0.017]	[0.017]	[0.017]
Log(1+FirmAge)	-0.562***	-0.597***	-0.604***
	[0.041]	[0.041]	[0.041]
ROA	-0.021	-0.044	-0.056
	[0.087]	[0.088]	[0.088]
Market to Book	0.043***	0.044***	0.046***
	[0.013]	[0.013]	[0.013]
Sales Growth	0.168***	0.169***	0.171***
	[0.020]	[0.020]	[0.020]
R&D	0.184***	0.188***	0.189***
	[0.023]	[0.023]	[0.023]
R&D Missing	-0.294***	-0.342***	-0.340***
	[0.081]	[0.082]	[0.081]
Capex	3.636***	3.669***	3.683***
	[0.411]	[0.410]	[0.411]
Tangibility	-2.100***	-2.122***	-2.149***
	[0.188]	[0.187]	[0.188]
Intangible Assets	-0.184	-0.288	-0.290
	[0.186]	[0.186]	[0.186]
Sales Vol.	0.367***	0.365***	0.369***
	[0.088]	[0.088]	[0.088]
Employment Rate	0.510	0.114	-0.387
	[0.632]	[0.621]	[0.631]
Log(Income Per Cap.)	-0.349	0.223	0.114
	[0.290]	[0.294]	[0.291]
Log(Population)	0.039	-0.007	
	[0.043]	[0.047]	
Ind. FE & Yr FE	Y	Y	Y
Adj. R^2	0.335	0.328	0.326
N	71334	71334	71334

Table 2.8: Addressing Potential Concerns

This table addresses potential concerns about our skilled labor risk measure. Panel A accesses the role of disclosure style in driving the results. Panel B accesses the effect of a major disclosure regulation in our sample period on the information content of Skilled Labor Risk. Panel C relates Skilled Labor Risk to traditional measures of firm risk and risk management. *Non-Skilled-Labor-Related Discussion* counts the number of sentences unrelated to skilled labor risk in the 10-K sections where a firm discusses skilled labor risk. If a firm does not discuss skilled labor risk, then *Non-Skilled-Labor-Related Discussion* counts the number of sentences in Item 1 and Item 7 before December 2005 and the number of sentences in Item 1, Item 1A, and Item 7 in 10-Ks after December 2005. To facilitate comparison of marginal effects, the dependent variables in Panels A and B are standardized by their own sample means. Total volatility is the standard deviation of daily stock return in a fiscal year. Idiosyncratic volatility is the standard deviation of the residual from a regression of daily stock returns on the three Fama-French factors in a fiscal year. Beta is the estimated coefficient on the market factor from a regression of daily stock returns on the three Fama-French factors in a fiscal year. For financial management, we focus on corporate cash holding and corporate leverage, both expressed in percentage points. # of SIC2 Rivals (50 mi radius) is standardized by its standard deviations. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively. In Panels A and B, letters a, b, and c represent statistical difference at 1%, 5%, and 10% levels, respectively, for the differences between the coefficients in column (1) and those in each of the other columns.

	Panel A: Non-Skilled Labor Disclosures as a Control and a Comparison		
	Baseline Estimation	Control for Disclosure Style	Non-Skilled-Labor-Related Discussion
	(1)	(2)	(3)
Non-Skilled-Labor-Related Discussion		0.001***	
		[0.000]	
# of SIC2 Rivals (50 mi radius)	0.077***	0.061***^{a}	0.030***^{a}
	[0.014]	[0.013]	[0.006]
Non-Compete	-0.008	-0.006	-0.003
	[0.005]	[0.005]	[0.003]
Real Estate Transfer Tax	-0.086***	-0.080***	-0.012^a
	[0.017]	[0.016]	[0.010]
Distance to Land-Grant U.	0.039***	0.034***^{a}	0.010***^{a}
	[0.004]	[0.003]	[0.002]
Firm&State Controls	Y	Y	Y
Ind. FE & Yr FE	Y	Y	Y
Adj. R^2	0.335	0.396	0.396
N	71334	71334	71334

	Panel B: Effects of the SEC Regulation	
	Before the Regulation	After the Regulation
	(1)	(2)
# of SIC2 Rivals (50 mi radius)	0.118***	0.061***[a]
	[0.024]	[0.016]
Non-Compete	-0.012	-0.004
	[0.008]	[0.006]
Real Estate Transfer Tax	-0.119***	-0.068***[a]
	[0.024]	[0.018]
Distance to Land-Grant U.	0.065***	0.026***[a]
	[0.006]	[0.003]
Firm&State Controls	Y	Y
Ind. FE & Yr FE	Y	Y
Adj. R^2	0.307	0.238
N	36094	35240

Panel C: Traditional Measures of Corporate Risk and Financial Management

	Traditional Measures of Corporate Risk			Financial Management		
	Total Volatility	Idiosyncratic Volatility	Beta	Cash Holding	Book Leverage	Market Leverage
	(1)	(2)	(3)	(4)	(5)	(6)
Skilled Labor Risk	0.028***	0.023***	0.017***	0.773***	-0.606***	-0.410***
	[0.005]	[0.005]	[0.002]	[0.045]	[0.059]	[0.045]
Log(Assets)	-0.495***	-0.550***	0.150***	0.653***	2.189***	0.902***
	[0.015]	[0.015]	[0.004]	[0.092]	[0.140]	[0.107]
Log(1+FirmAge)	-0.288***	-0.272***	-0.059***	-2.620***	1.038***	0.945***
	[0.028]	[0.028]	[0.008]	[0.215]	[0.329]	[0.267]
ROA	-1.582***	-1.563***	-0.074**	-2.230***	-5.688***	-6.030***
	[0.148]	[0.149]	[0.030]	[0.768]	[0.878]	[0.523]
Market to Book	-0.064***	-0.076***	0.049***	1.262***	-1.106***	-2.874***
	[0.010]	[0.010]	[0.003]	[0.073]	[0.087]	[0.082]
Sales Growth	0.031*	0.028	0.016**	1.175***	-0.147	-0.458***
	[0.018]	[0.018]	[0.007]	[0.117]	[0.149]	[0.113]
R&D	-0.077***	-0.080***	0.002	3.209***	-0.715***	-0.476***
	[0.014]	[0.014]	[0.005]	[0.120]	[0.125]	[0.078]
R&D Missing	0.067	0.089*	-0.058***	-3.313***	4.475***	5.293***
	[0.047]	[0.047]	[0.014]	[0.375]	[0.569]	[0.484]
Tangibility	0.134	0.181	-0.213***	-52.545***	36.054***	29.454***
	[0.134]	[0.132]	[0.036]	[1.134]	[1.526]	[1.274]
Intangible Assets	0.137	0.181	-0.233***	-55.042***	31.934***	23.049***
	[0.114]	[0.112]	[0.032]	[0.917]	[1.230]	[0.958]
Modified Zscore	-0.038***	-0.038***	-0.006***	-0.101***	-0.194***	-0.021
	[0.009]	[0.009]	[0.001]	[0.037]	[0.052]	[0.023]
Dividend Payer	-0.777***	-0.739***	-0.151***	-1.052***	-7.960***	-9.983***
	[0.046]	[0.045]	[0.015]	[0.339]	[0.550]	[0.445]
Ind. FE & Yr FE	Y	Y	Y	Y	Y	Y
Adj. R^2	0.486	0.504	0.195	0.589	0.280	0.359
N	24474	24474	24474	52355	52253	52253

Table 2.9: Skilled Labor Risk and Executive Compensation Structure: First Instrument

This table reports the OLS and 2SLS estimations of the effects of skilled labor risk on the incentive structure and the level of executive compensation. We use the 1997 residential real estate transfer tax rate in a firm's headquarters state as an instrument for the skilled labor risk. The incentive structure and total compensation data is available from 1996 to 2013. In all estimations, *Total Pay* is the natural logarithm of the total compensation for the executive team and CEOs. In the OLS estimation for the executive team, we control firm size, firm age, return on assets, market to book ratio, sales growth, R&D expense, a dummy variable indicating missing R&D values, capital expenditure, tangibility, intangible assets, sales volatility, CEO dual role dummy, a dummy variable indicating missing CEO dual role values, the employment rate in the headquarters state, the natural logarithm of income per capita in the headquarters state, and the natural logarithm of total population in the headquarters state. In the OLS estimation for CEOs, we further control natural logarithm of CEO age and CEO tenure. In the IV estimations for both the executive team and CEOs, we further control the home ownership rate at the state level. Panels A and B present results for the executive team and the CEOs, respectively. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	Panel A: Executive Team				
	OLS		IV		
	Incentive/Total	Total Pay	First-Stage	Incentive/Total	Total Pay
Skilled Labor Risk	0.002***	0.006***		0.039***	-0.002
	[0.001]	[0.002]		[0.010]	[0.027]
Real Estate Transfer Tax (Yr 1997)			-0.560***		
			[0.090]		
First-stage F-stat			38.30		
Firm&State Controls	Y	Y	Y	Y	Y
Ind. FE & Yr. FE	Y	Y	Y	Y	Y
	Panel B: CEO				
	OLS		IV		
	Incentive/Total	Total Pay	First-Stage	Incentive/Total	Total Pay
Skilled Labor Risk	0.002**	0.001		0.042***	0.053
	[0.001]	[0.003]		[0.011]	[0.034]
Real Estate Transfer Tax (Yr 1997)			-0.550***		
			[0.090]		
First-stage F-stat			36.98		
Firm&State Controls	Y	Y	Y	Y	Y
Ind. FE & Yr. FE	Y	Y	Y	Y	Y

Table 2.10: Skilled Labor Risk and Executive Compensation Structure: Second Instrument

This table reports the 2SLS estimations of the effects of skilled labor risk on the level and the incentive structure of executive compensation. We use home equity shock as an instrument for the skilled labor risk and home equity shock is defined as the yearly change in the national house price index the Federal Housing Finance Agency divided by the topological elasticity of housing supply at the MSA level. The incentive structure and total compensation data is available from 1996 to 2013. In all estimations, *Total Pay* is the natural logarithm of the total compensation for the executive team and CEOs. In both stages of estimations, the control variables include all the firm-level independent variables other than skilled labor risk in Table 9. Panels A and B present first and second-stage estimations for the compensation structure and level of the executive team and the CEOs, respectively. The total compensation levels for the executive team and CEOs are adjusted by the average regional price parities at the MSA level between 2008 and 2014. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	Panel A: Executive Team		
	First-Stage	Incentive/Total	Total Pay
Skilled Labor Risk		0.026***	0.018
		[0.009]	[0.022]
House Price Growth Rate/MSA elasticity	12.046***		
	[1.897]		
First-stage F-stat	40.31		
Firm Controls	Y	Y	Y
Ind. FE & Yr. FE	Y	Y	Y
	Panel B: CEO		
	First-Stage	Incentive/Total	Total Pay
Skilled Labor Risk		0.035***	0.026
		[0.012]	[0.029]
House Price Growth Rate/MSA elasticity	12.398***		
	[1.940]		
First-stage F-stat	40.82		
Firm Controls	Y	Y	Y
Ind. FE & Yr. FE	Y	Y	Y

Table 2.11: Skilled Labor Risk and Compensation Structure for Non-chief-executive Employees

This table reports the OLS and 2SLS estimations of the effects of skilled labor risk on the incentive structure and level of the compensation for non-chief-executive employees. The dependent variable in columns (1)-(3), *Incentive/Total*, is the fraction of the Black-Scholes value of broad-based stock options (BBSO) granted to the non-executive employees in total compensation for the non-chief-executive employees. We follow the procedure in Aldatmaz et al. (2016) to estimate the Black-Scholes value of BBSO granted to the non-chief executive employees. To capture the total compensation for the non-chief-executive employees, we use the total staff expense reported in Compustat (item XLR) minus the total compensation for the top five executives. We use the product of the average annual pay per employee in Quarterly Census of Employment and Wages (QCEW) and a firm's total employment to impute the missing values in XLR and the total compensation for the top five executives is calculated as the average compensation for an executive in a firm multiplied by five. Incent./Total is set as missing if it is less than zero or larger than or equal to one. The dependent variable in columns (4)-(6), *Total Pay*, is the natural logarithm of the total compensation for the non-chief-executive employees. The total compensation in column (6) is adjusted by the average regional price parities at the MSA level between 2008 and 2014. In columns (2) and (5), we report the IV estimations (IV1) using the 1997 residential real estate transfer tax rate in a firm's headquarters state as an instrument for the skilled labor risk. Except for the dependent variable, the empirical specifications are the same as the one in Table 12. In columns (3) and (6), we report the IV estimations (IV2) using home equity shock as an instrument for the skilled labor risk. Except for the dependent variable, the empirical specifications are the same as the one in Table 9. Home equity shock is defined as the yearly change in the national house price index the Federal Housing Finance Agency divided by the topological elasticity of housing supply at the MSA level. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	Incentive/Total			**Total Pay**		
	OLS	IV1	IV2	OLS	IV1	IV2
	(1)	(2)	(3)	(4)	(5)	(6)
Skilled Labor Risk	0.007***	0.022**	0.030***	0.011***	0.041*	0.072***
	[0.001]	[0.009]	[0.010]	[0.003]	[0.025]	[0.021]
First-stage F-stat		32.84	27.88		32.84	32.59
Firm&State Controls	Y	Y	Y	Y	Y	Y
Ind. FE & Yr. FE	Y	Y	Y	Y	Y	Y

Table 2.12: Skilled Labor Risk and Salary for Skilled Labor

This table reports the OLS and 2SLS estimations of the effects of skilled labor risk on the salary of the skilled labor. We use the natural logarithm of proposed salary for a foreign employee in the labor condition application (LCA) filed by the employer, Log(Salary for Skilled Labor), as a proxy for the salary for skilled labor. In all estimations, we only keep observations in which the job is full time and the state of an employee's worksite is the same as the employer's headquarters state. We use the home equity shock as an instrument for the skilled labor risk. In all estimations, we control the natural logarithm of prevailing wage for each foreign employee and the same firm-level characteristics as in Table 9. Skilled Labor Risk and all firm-level controls are lagged one fiscal year. The prevailing wage is defined as the average wage paid to similarly employed workers in a specific occupation in the area of intended employment. Home equity shock is defined as the yearly change in the national house price index the Federal Housing Finance Agency divided by the topological elasticity of housing supply at the MSA level. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	Log(Salary for Skilled Labor)	
	OLS	IV2
	(1)	(2)
Skilled Labor Risk	0.004**	0.057***
	[0.002]	[0.016]
First-stage F-stat		23.60
Firm Controls & Prevailing Wage	Y	Y
Ind. FE & Yr. FE	Y	Y

Table 2.13: Skilled Labor Risk and Strengths of Employee Relations

This table reports the OLS and 2SLS estimations of the effects of skilled labor risk on the strengths of employee relations. The data on the strengths of employee relations is from the MSCI database. The dependent variable in Panel A is *Total Strengths of Employee Relations*, which is defined as the average rating across all dimensions in employee relations. The dependent variable in columns (1)-(3) of Panel B is *Compensation&Benefits-Related Strengths*, which is defined as the average rating in employee relations related to compensation and benefits. There are four dimensions related to compensation&benefits including cash profit sharing, employee involvement, retirement benefits, and compensation & benefits. The dependent variable in columns (4)-(6) of Panel B is *Other Strengths*, which is defined as the average rating in employee relations that are not related to compensation or benefits. All dependent variables are forwarded one year. For the IV estimations (IV1) using the 1997 residential real estate transfer tax rate in a firm's headquarters state as an instrument for the skilled labor risk, the empirical specifications are the same as the one in Table 12 except for the dependent variables. For the IV estimations (IV2) using home equity shock as an instrument for the skilled labor risk, the empirical specifications are the same as the one in Table 9 except for the dependent variables. Home equity shock is defined as the yearly change in the national house price index the Federal Housing Finance Agency divided by the topological elasticity of housing supply at the MSA level. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	Panel A: Total Strengths of Employee Relations		
	OLS	IV1	IV2
	(1)	(2)	(3)
Skilled Labor Risk	0.000	0.010*	0.009*
	[0.000]	[0.005]	[0.005]
First-stage F-stat		36.25	44.03
Firm&State Controls	Y	Y	Y
Ind. FE & Yr. FE	Y	Y	Y

	Panel B: Compensation&Benefits-Related v.s. Other Strengths					
	Compensation&Benefits-Related			Other		
	OLS	IV1	IV2	OLS	IV1	IV2
	(1)	(2)	(3)	(4)	(5)	(6)
Skilled Labor Risk	0.001*	0.022**	0.017**	-0.001	0.005	0.001
	[0.001]	[0.009]	[0.008]	[0.000]	[0.005]	[0.005]
First-stage F-stat		35.23	45.07		36.25	44.03
Firm&State Controls	Y	Y	Y	Y	Y	Y
Ind. FE & Yr. FE	Y	Y	Y	Y	Y	Y

Chapter 3

Labor Adjustment Costs and Risk Management

3.1 Introduction

Do firms use derivative hedging to manage the risk associated with labor adjustment costs? Although the recent asset pricing literature shows that labor adjustment costs have an impact on corporate risk (Ochoa, 2013; Belo, Lin, and Bazdresch, 2014), little is known about whether and how firms' risk management policies are affected when adjustments to labor forces are costly. In this paper, we first use a model to show how labor adjustment costs affect corporate hedging and then provide supporting empirical evidence of the mechanism.

In the theoretical model, we integrate labor adjustment costs into the risk management model in Froot, Scharfstein, and Stein (1993) and show that a firm increases the optimal hedging ratio when labor adjustment costs are larger. The underlying economic mechanism is as follows. Labor adjustment costs slow a firm's reaction to aggregate economic conditions and attenuate the correlation between the firm's internal fund, which is correlated with the state of the world, and its profit. As a result, the firm has more incentives to engage in risk management to smooth cash flows.

To empirically measure corporate risk management, we develop Perl scripts and extract data from corporate 10-K filings in the U.S. Securities and Exchange Commission's Electronic Data Gathering, Analysis, and Retrieval database (EDGAR) from 1996 to 2014. Using this data set, we develop text-based measures for corporate derivative hedging (Hoberg and Moon, 2016; Almeida, Hankins, and Williams, 2016). To capture a firm's labor adjustment costs, we use three measures. The first measure is firm-level union power. Labor unions have the reputation of providing job security for employees covered by a collective bargaining agreement (CBA), and as a consequence, firing costs are expected to be higher for firms

with stronger union power. The second measure is the extent to which firms are constrained by wrongful-discharge laws (WDLs) recognized by courts in headquarters states. WDLs restrict employers' ability to fire employees at will and therefore increase firms' firing costs. The third measure is a firm's reliance on skilled labor, since labor with higher skill levels is associated with larger adjustment costs (Oi, 1962; Ochoa, 2013). In particular, we use the fraction of high-skilled labor at the industry level as a proxy for the measure at the firm level (Belo, Lin, Li, and Zhao, 2016). We have five main empirical findings.

First, we show that firms with stronger union power use more derivative contracts to manage risk. In particular, ordinary least squares (OLS) estimations suggest that compared with non-unionized firms, the probability of using derivative contracts to manage foreign currency or commodity price risk is 7.9% higher for unionized firms, a 14.5% increase relative to the sample mean. Moreover, compared with non-unionized firms, unionized firms discuss foreign currency or commodity hedging in 10-K filings 0.72 more times, a 29.6% increase relative to the sample mean. We further employ the propensity score matching method to mitigate the concern that OLS estimations could be driven by sample selection. In particular, we match each unionized firm with a non-unionized firm in the same three-digit SIC industry and calendar year based on a set of firm characteristics. We make sure that the matched unionized firms are indistinguishable from the matched non-unionized firms on observable characteristics. The matching estimators also show that unionized firms engage in more hedging activities, suggesting that such a positive relationship is not driven by sample selection on observable characteristics.

Second, we estimate the effects of the adoption of the right-to-work (RTW) laws on corporate hedging. In particular, we exploit the fact that Oklahoma, Indiana and Michigan adopted the RTW laws at different time in our sample and employ a difference-in-difference (DiD) method to estimate the causal effects. Specifically, the results show that the adoption of the RTW laws, which weaken the bargaining power of labor unions, leads to 0.30 fewer mentions about foreign currency or commodity hedging activities in 10-Ks, a 12.2% decrease relative to the sample mean. Further evidence on the dynamic treatment effects show that the parallel trends assumption is more likely to be satisfied in our sample. The DiD estimations suggest that firms engage in less derivative hedging when labor constraints are relaxed and are complementary to the evidence based on the firm-level union power measures.

Third, we find that firms moving to headquarters states that recognized more common law exceptions to the at-will employment doctrine in WDLs use more derivative contracts to manage foreign currency or commodity price risk. Under the assumption that the reasons for corporate headquarters relocation are not related to relaxing the constraints on at-will firing, corporate headquarters relocation generates exogenous variations in the extent to which

firms are constrained by WDLs. Specifically, we find that when a firm moves to a state that recognized one more common law exception than the previous headquarters state, the firm is 3.4% more likely (a 6.2% increase relative to the sample mean) to engage in foreign currency or commodity derivative hedging and discusses foreign currency or commodity derivative hedging in annual reports 0.24 more times (a 10.0% increase relative to the sample mean).

Fourth, we find that firms in industries that rely more on high-skilled employees use more derivative contracts for risk management. In particular, the estimations show that with a one-standard-deviation increase in the industry-level skilled labor reliance measure, a firm is 1.7% more likely to use derivative contracts, a 3.0% increase relative to the sample mean, and discusses derivative hedging activities in 10-Ks 0.18 more times, a 7.5% increase relative to the sample mean.

Fifth, we find that firms spend less effort in managing the risk if the mobility of skilled labor is restricted at the headquarters state level. Specifically, when the non-compete covenant enforcement index increases from the 25th percentile (a value equal to 3) to the 75th percentile (a value equal to 6) in the sample, the effects of a one-standard-deviation increase in the industry-level skilled labor reliance measure on derivative hedging probability and the number of mentions about derivative hedging activities are reduced by 0.7% (a 1.4% decrease relative to the sample mean) and by 0.06 times (a 2.5% decrease relative to the sample mean), respectively. The results are qualitatively similar if we use the adoptions of the Inevitable Disclosure Doctrine (IDD) by state courts or transfer tax rates on residential real estate transactions as policies that restrict the mobility of skilled labor. The estimations suggest that labor mobility or the inalienability of human capital is one channel through which skilled labor reliance affects corporate risk management.

Our first three findings show that labor adjustment costs arising from labor market institutions have impacts on corporate hedging. The last two findings further suggest that corporate hedging is also affected by labor adjustment costs arising from the nature of human capital. Overall, the estimations suggest that both types of labor adjustment costs affect corporate risk management in a significant way.

Our paper fits into two strands of literature. First, this paper contributes to the rising literature on the interaction between the labor market and corporate finance. On the relation between labor adjustment costs and corporate policies, the current literature focuses on financial leverage and cash holding. Schmalz (2015) studies the impact of labor unionization on the corporate leverage ratio and cash holding. In particular, he shows that financially constrained firms decrease leverage and hold more cash when union power increases. Serfling (2016) also examines how labor adjustment costs affect corporate leverage. Specifically, he exploits the staggered adoptions of WDLs across U.S. states and shows that firms decrease leverage to reduce the indirect costs of financial distress when firms' firing costs increase.

Using international data, Simintzi, Vig, and Volpin (2015) also reach a conclusion similar to that in Serfling (2016) .

In this paper, we extend the literature by studying the impact of labor adjustment costs on corporate derivative hedging. Our results suggest that when labor adjustment costs increase, firms use more derivative contracts to manage risk and increase their ability in smoothing cash flows. Our results imply that firms employ policies beyond cash holding or financial leverage when facing more labor constraints. Our paper also differs from the existing literature by examining the relation between the labor adjustment costs arising from firms' reliance on skilled labor and corporate risk management. In particular, we show that firms that rely more on skilled labor engage in more derivative hedging, and such relation is attenuated when the mobility of skilled labor is restricted. Our results are consistent with the evidence in a recent paper Baghai, Silva, Thell, and Vig (2016), which show that capital structure decisions are more conservative for Swedish firms when they rely more on skilled labor.

Second, our paper also contributes to the literature on corporate risk management. Prior studies have shown that corporate risk management is influenced by various factors including firm size and dividend policy (e.g., Nance, Smith, and Smithson, 1993); financial distress (e.g., Purnanandam, 2008; Rampini, Sufi, and Viswanathan, 2014); and the substitution between operational hedging and derivative hedging (e.g., Almeida, Hankins, and Williams, 2016). In this study, we extend the literature by showing that the presence of labor adjustment costs also creates incentives for firms to engage in risk management, after controlling for the important determinants identified in the current literature. Our results suggest that labor market frictions have important implications for corporate risk management.

3.2 Hypothesis Development

In order to guide the empirical tests, we present a theoretical model and derive a firm's optimal hedging position in the presence of labor adjustment costs. We then utilize the model to study the incremental effect of labor adjustment costs on the optimal hedging position and generate empirical predictions.

3.2.1 A Simple Model

We integrate labor adjustment costs into the risk management model in Froot, Scharfstein, and Stein (1993). In particular, we assume that labor is the only input in the production function and that it is costly for firms to hire or lay off employees in each period. Following Froot et al. (1993), we maintain the assumption that the internal fund is not sufficient for

financing labor at each date and that the firm needs to engage in costly external financing from capital markets. The model has three dates, and the timeline is as follows.

(1) At date 0, the firm makes labor investment l_0 and hedging decision h. The initial labor stock is assumed to be zero. We also assume that the firm starts with internal fund ω_0 at date 0 and that the wage for each unit of labor is constant across periods. The labor and hedging decisions at date 0 maximize the present value of the expected dividends in both periods.

(2) At date 1, there is a continuum of states, and each state is characterized by the realization of a random variable ϵ, which is assumed to be normally distributed with a mean equal to one and a standard deviation equal to σ. Given the chosen hedging strategy at date 0, the internal fund in each state at date 1 is determined. In each state, the firm makes a labor investment decision, taking the internal fund as given.

(3) At date 2, the output from production is realized and outside investors are repaid. The discount rate is assumed to be zero.

In the following, we formulate the firm's optimal decision problems at date 1 and date 0 and solve the model via backward induction. The firm's date 1 problem is formulated as follows. Given the hedge ratio, h, chosen at date 0, the internal fund at date 1 in each state ϵ is defined as $\omega = (\omega_0 - Wl_0)(h + (1-h)\epsilon)$. Taking the internal fund ω at date 1 as given, the firm's profit is defined as

$$\theta f(l_1) - \bar{W} l_1 - C(e) - \frac{\eta}{2}(l_1 - l_0)^2$$

where l_1 is the units of labor retained in state ϵ at date 1 and we set the wage, $\bar{W}$, to be fixed across two dates to capture wage rigidity. The term $C(e)$ captures the costs of external financing e where $e = \bar{W} l_1 - \omega$. We assume $C_e > 0$ and $C_{ee} > 0$, $f_l > 0$ and $f_{ll} < 0$.

The term $\theta = 1 + \alpha_0(\epsilon - 1)$ captures the sensitivity of revenue to the underlying risk. The term $\frac{\eta}{2}(l_1 - l_0)^2$ captures the labor adjustment costs. The variable η is interpreted as the level of difficulty in adjusting the labor force. Labor adjustment costs reduce the firm's profit if $|l_1 - l_0|$ units of labor are adjusted in each state at date 1.

Therefore, the firm's decision problem in state ϵ at date 1 is

$$\begin{aligned} P(\omega, l_0) = \underset{l_1}{\text{Max}} \quad & \theta f(l_1) - \bar{W} l_1 - C(e) - \frac{\eta}{2}(l_1 - l_0)^2 \\ \text{subject to} \quad & e = \bar{W} l_1 - \omega \\ & \omega = (\omega_0 - Wl_0)(h + (1-h)\epsilon) \\ & \theta = 1 + \alpha_0(\epsilon - 1), \alpha_0 > 0. \end{aligned}$$

At date 0, the firm makes labor hiring and hedging decisions to maximize the present

value of expected dividends. The date 0 labor investment decision l_0 and hedging decision h solve the following problem:

$$\begin{aligned} \underset{l_0,h}{\text{Max}} \quad & f(l_0) - \bar{W}l_0 - \frac{\eta}{2}l_0^2 + E[P(\omega, l_0)] \\ \text{subject to} \quad & \omega = (\omega_0 - \bar{W}l_0)(h + (1-h)\epsilon) \\ & \bar{W}l_0 \leq \omega_0. \end{aligned}$$

3.2.2 Model Solution

We solve the firm's problem via backward induction. In the first step, we solve the firm's labor investment decision for each state at date 1, taking the firm's internal fund as given. In the second step, we turn to solving the labor investment and hedging decisions at date 0.

The first order condition for the labor investment decision in state ϵ at date 1 is as follows, applying the envelope theorem:

$$\theta f_l(l_1) - \eta l_1 = \bar{W} + \bar{W}C_e - \eta l_0 \tag{3.1}$$

$$P_\omega(\omega, l_0) = C_e \tag{3.2}$$

$$P_{l_0}(\omega, l_0) = \eta(l_1 - l_0). \tag{3.3}$$

The first order condition for the optimal hedging ratio at date 0 is

$$E[P_\omega \frac{d\omega}{dh}] = E[P_\omega(1-\epsilon)] = Cov(P_\omega, \epsilon) = 0. \tag{3.4}$$

Since ϵ is assumed to be normally distributed, $Cov(P_\omega, \epsilon)$ can be rewritten as

$$E[\frac{dP_\omega}{d\epsilon}] = 0 = E[C_{ee}(\bar{W}\frac{dl_1}{d\epsilon} - (\omega_0 - \bar{W}l_0)(1-h))]. \tag{3.5}$$

By taking a derivative with respect to ϵ on both sides of Equation (2), we have

$$\frac{dl_1}{d\epsilon} = \frac{\bar{W}C_{ee}(\omega_0 - \bar{W}l_0)(1-h) + \alpha f_l}{\bar{W}^2 C_e e - \theta f_{ll} + \eta}. \tag{3.6}$$

By substituting Equation (3.6) into Equation (3.5) and using the fact that $P_{\omega\omega} = \frac{C_{ee}(\theta f_{ll} - \eta)}{\bar{W}^2 C_{ee} + \eta - \theta f_{ll}}$, we have[1]

[1]The proof for this part is available in Appendix A.3.2.

$$h^* = 1 + \frac{\alpha_0}{\omega_0 - \bar{W} l_0} \frac{E[\frac{P_{\omega\omega} f_l}{\theta f_{ll} - \eta}]}{E[P_{\omega\omega}]}. \tag{3.7}$$

The first order condition for optimal labor hiring is

$$f_l(l_0) - \bar{W} - \eta l_0 + E[P_\omega \frac{\partial \omega}{\partial l_0} + P_{l_0}] = 0. \tag{3.8}$$

Simplifying terms and using Equation (3.4), we have

$$f_l(l_0) - \bar{W} - \eta l_0 - \bar{W} E[P_\omega] + \eta(E l_1 - l_0) = 0. \tag{3.9}$$

Therefore, the optimal hedging and labor investment decisions are characterized by the following equations:

$$h = 1 + \frac{\alpha_0}{\omega_0 - \bar{W} l_0} \frac{E[\frac{P_{\omega\omega} f_l}{\theta f_{ll} - \eta}]}{E[P_{\omega\omega}]} \tag{3.10}$$

$$f_l(l_0) - \bar{W} - \eta l_0 - \bar{W} E[P_\omega] + \eta(E l_1 - l_0) = 0 \tag{3.11}$$

$$\theta f_l(l_1) - \eta l_1 = \bar{W} + \bar{W} C_e - \eta l_0. \tag{3.12}$$

In order to examine the incremental impact of labor adjustment costs on the optimal hedging position, we assume that the production function is Cobb-Douglas and that labor adjustment costs are in the quadratic form, and we solve the model numerically. Figure 3.1 presents the relation between labor adjustment costs and the optimal hedging position in the model, given certain parameters. The results suggest that when labor force adjustment is more costly, firms engage in more corporate hedging activities.

The analytical solution to Equations (10)-(12) is not available without making further assumptions. When the production function is further assumed to be linear in labor, we can solve the model analytically. The results are summarized in the following proposition, and the proof is available in Appendix A.3.2.

Proposition: *If the production function is linear and the external financing cost is quadratic, then the optimal hedging ratio is higher for firms with larger labor adjustment costs, that is,* $\frac{\partial h^*}{\partial \eta} > 0$.

3.2.3 Empirical Predictions

The theoretical prediction from the model is that a firm increases the optimal hedging ratio when labor adjustment costs are larger. The driving force behind this relation is that the presence of labor adjustment costs decreases the firm's flexibility in adjusting labor forces and therefore attenuates the correlation between the firm's investment opportunities and its internal fund, which creates more incentives for the firm to engage in corporate risk management to smooth cash flows. The empirical prediction is summarized in the following hypothesis:

Hypothesis: Firms with larger labor adjustment costs use more derivative hedging.

Measuring labor adjustment costs empirically is central to testing the hypothesis, and we use three empirical settings. The first setting that we explore is labor unionization. Labor unions have the reputation of providing employment protections for employees covered by a CBA. For example, Abraham and Medoff (1984) show that unions provide more job protection for senior workers in unionized firms than in non-unionized firms. Moreover, once employers and employee representatives enter a CBA, it cannot be modified during the effective period, or otherwise the employers would be engaging in unfair labor practices (Dawson, 2015).[2] Therefore, firms that are stuck with long-term CBAs during downturns are also less flexible in adjusting their labor force. Overall, the presence of labor unions in firms makes laying off employees more costly for employers. As a result, we expect firms with stronger union power to engage in more derivative hedging activities to manage the risk associated with labor adjustment costs.

To enable the empirical test, we develop measures for union power at the firm level based on 10-Ks and perform analysis using OLS and propensity score matching estimators. Furthermore, we also analyze the impacts of the introduction of the RTW laws on corporate derivative hedging to test the hypothesis.

In addition to labor unionization, labor laws also provide protections for employees. In this paper, we are specifically interested in the employment protections provided by WDLs, which were adopted by a majority of U.S. states. In each state, before the adoption of WDLs, employers could fire employees at will. However, the three common law exceptions in WDLs-the good faith exception, the implied contract exception and the public policy exception-restrict employers' ability to fire employees at will. As a result, when the state court recognized one or more common law exceptions to at-will employment doctrine, firing costs increased for employers located in the state. This provides us with a good empirical setting in which to test the theoretical prediction.

In the analysis, we explore the empirical setting of corporate headquarters relocation.

[2]National Labor Relation Act, 29 U.S.C. Â§ 158(a)(1), (a)(5) (2006).

Under the assumption that the reasons for corporate headquarters relocation are not related to relaxing the constraints on at-will firing, corporate headquarters relocation generates exogenous variations in the extent to which firms are constrained by WDLs. In particular, we expect that a firm would increase derivative hedging when it moves its headquarters to a state that adopted more common law exceptions in WDLs than the previous headquarters state.

In the final empirical setting, we consider the type of labor adjustment costs arising from the nature of human capital. In particular, Oi (1962) argues that labor with higher skill levels is associated with larger labor adjustment costs. More recently, Ochoa (2013) provides new evidence on the positive relationship between labor skill level and labor adjustment costs using data from the 1980 Employment Opportunity Pilot Project. Consequently, firms that rely more on skilled labor are less flexible in adjusting their labor stock in response to economic shocks and are predicted to engage in more derivative hedging activities. To test this prediction, we employ an industry-level labor skill level measure as a proxy for the extent to which firms rely on high-skilled labor. We expect that firms in industries with a higher fraction of high-skilled labor use more derivative contracts for risk management.

The correlation between skilled labor reliance and corporate risk management is related to employees' labor mobility. If employees are restricted from leaving their current employers, the labor adjustment costs associated with skilled labor would disappear. In this case, we would not expect to observe any effect of skilled labor reliance on derivative hedging. However, human capital is inalienable, and employees can make decisions to leave their current companies and join or form other companies. Such labor mobility therefore creates the risk of losing employees, especially during downturns (Baghai et al., 2016). As a result, for firms that rely on skilled labor, outflows of talented employees reduce cash flows when firms' performance is bad, which exposes firms to additional risk. If the mobility of skilled labor's is restricted, we would expect the effect of skilled labor reliance on corporate derivative hedging to be attenuated.

In order to test this conjecture, we exploit three state policies that restrict the mobility of skilled labor. The first is the state-level enforcement of non-compete agreements, which restrict employees from joining or forming rival companies. The second is the adoptions of the IDD by state courts, which prevent the employees who have the knowledge of firms' trade secrets from working for rival firms. Finally, we also exploit the transfer tax rates on the residential real estate transactions at the state level and such tax rates affect the mobility of skilled labor since they increase the moving costs of homeowners and skilled labor are likely to own houses. We expect the effect of skilled labor reliance on corporate derivative hedging to be attenuated if firms are headquartered in states in which skilled labor are more restricted to move.

3.3 Data

3.3.1 Corporate Derivative Hedging Data

We develop Perl scripts to download and parse 10-K filings in the SEC's EDGAR database and quantify firms' derivative hedging activities. In particular, we use the Perl scripts to search keywords related to derivative hedging in each firm's 10-K, 10-K405, 10-KSB, 10-KT, 10KSB, 10KSB40, and 10KT405 filings in the EDGAR database. In this paper, we focus on foreign currency (FX) and commodity hedging. We do not examine the effect of labor adjustment costs on interest rate derivative hedging, since an increase in labor adjustment costs leads to lower corporate leverage (Serfling, 2016), which in turn mechanically reduces corporate interest rate hedging activities and would introduce confounded effects into our estimations. The SEC has required electronic filings since May 1996; therefore, our data on corporate derivative hedging consist of all non-financial, non-utility and U.S. headquartered firms between fiscal year 1996 and 2013 in the EDGAR database.

The procedure of data extraction for FX hedging closely follows Hoberg and Moon (2016). A firm is defined to use FX hedging contracts in a year if it mentions one word from *each* of the following three lists in a 25-word window in a paragraph in the annual report:

List 1: "Currency", "Currencies", "Foreign Exchange";

List 2: "Forward", "Future","Option", "Swap", "Spot", "Derivative", "Hedge", Hedging", "Hedged";

List 3: "Contract", "Position", "Instrument", "Agreement", "Obligation", "Transaction", "Strategy", "Strategies".

In order to exclude the false positive hits in our extractions, we further exclude the following terms: (1) not use currency/currencies/foreign exchange/derivative; (2) not hedge/hedging/hedged and (3) forward(-)looking or in the future.

We develop two measures for corporate FX hedging activities. The first measure is *FX Hedge*, which is a dummy variable equal to one if a firm uses FX hedging contracts in a year and zero otherwise. The second measure is # *FXMentions*, which measures how many times a firm mentions FX hedging in a year using the keyword lists specified above.

For commodity hedging, we use the keyword list in Almeida et al. (2016). The keywords list is too long to be listed in the paper but is available in the Appendix A.2. In particular, the Perl script parses a 10-K filing into sentences and a firm is defined to use commodity hedging contracts in a year if at least one sentence in its 10-K filing contains any keyword in the list. We also develop two measures for corporate commodity hedging activities. For the extensive margin, *Commodity Hedge* is a dummy variable equal to one if a firm uses commodity hedging contracts in a year and zero otherwise. For the intensive margin, # *CommodityMentions* is defined as the total number of sentences that contain keywords from

the keyword list in a firm's 10-K filing in a year .

In this paper, we are interested in the effect of labor adjustment costs on the aggregate hedging activities in a firm. As a result, we aggregate both the FX and commodity hedging activities for each firm in a year. In particular, we define *Hedging Dummy* as a dummy variable equal to one if *FX Hedge* or *Commodity Hedge* is one and zero otherwise. The measure *# of Mentions* is defined to be the sum of *# FXMentions* and *# CommodityMentions*. In the final sample, if a firm has no exposure to foreign currency or commodity price risk, we set *# FXMentions* or *# CommodityMentions* to zero.

It is important to realize that some firms do not use derivative contracts for hedging simply because they are not exposed to foreign currency or commodity price risk. To identify whether a firm has ex ante foreign currency or commodity price exposure, we follow the procedures in Purnanandam (2008). We exclude firm-year observations in which there is no ex ante exposure to foreign currency and commodity price risk from the final sample.

Table 3.1 reports the summary statistics for the firm-level derivative hedging data. In the sample, 55% of firm-year observations use foreign currency or commodity derivative contracts for hedging. Furthermore, sample firms on average mention foreign currency or commodity hedging activities 2.4 times in the 10-K. The summary statistics are similar to the results in Table 3 of Hoberg and Moon (2016).

3.3.2 Firm-Level Union Power Data

The firm-level union power data are not readily available and the literature commonly uses the union coverage data at the census industry level as a proxy for the union power at the firm level. Instead of following the common practice in the literature, we develop another Perl script and construct firm-level union power measures based on 10-K filings. The information on a firm's unionization status or union coverage rate is usually disclosed in Item 1 "Business". We use the Perl script to parse Item 1 into sentences and search the following lists of keywords in each sentence to construct the firm-level union power measures. A firm is defined to be unionized if the firm mentions at least one sentence in Item 1 containing the combinations of phrases in the following order in 10-Ks:

List 1: "Represented/covered by/under/in" or "a party/pursuant/signatory/subject to";

List 2: "a/any/various";

List 3: "Collective Bargaining", "Labor Union(s)", "Labor Organization(s)", "Labor Contract(s)", "Labor Agreement(s)", "Union(s)".

We further exclude false positive hits. In particular, we consider a firm as not unionized if the extracted sentence contains any of the following phrases:

(1) no/neither [any words] employee/company/companies/entity/entities/borrower/personnel/work

force;

(2) neither [any words] nor [any words] is/are;

(3) none or none of.

In addition to the unionization dummy variable, we also extract the union coverage rate if such information is available. If only the number of employees covered by a CBA is available, we define the union coverage rate as the extracted data divided by the firm's total employment from Compustat. The data also covers all non-financial, non-utility and U.S. headquartered firms between fiscal year 1996 and 2013. The summary statistics for the firm-level union power measures are available in Table 3.1. In the sample, around 9.5% of firms are unionized, and the average union coverage rate in the sample is 1.5%.

3.3.3 Industry-Level Labor Skill Data

We employ the industry-level labor skill data to measure labor adjustment costs (Ochoa, 2013). The data are obtained from Belo et al. (2016) and are available from 1991 to 2013.[3] An industry is defined at the three-digit SIC level before 2002 and at the four-digit NAICS level since 2002. In the data, labor skill measure is defined as the fraction of labor with high-skilled occupations in each industry-year observation. The skill level of each occupation is measured by Specific Vocational Preparation (SVP), which measures the amount of lapsed time required by a typical worker to learn the techniques, acquire the information, and develop the facility needed for average performance in a specific job-worker situation.[4] The SVP measure ranges from 1 to 9, and Belo et al. (2016) define an occupation requiring high skill if its SVP is greater than or equal to 7. The summary statistics for labor skill measure at the industry-year level are reported in Table 3.1. In the sample, an average industry has 20% of employees with a high level of skill. The time-series variation in this measure is small in each industry, and the variation in the data mainly comes from cross-industry variation.

3.3.4 State Policies Related to Labor Mobility

We explore three state policies that restrict labor mobility. For the state-level enforcement of non-compete agreements, we use the enforcement index data in Garmaise (2011) and the data is only available till 2004. For the adoptions of IDD, we use the data in Klasa, Ortiz-Molina, Serfling, and Srinivasan (2016). For the real estate transfer tax rates, the data before 2006 are hand-collected from state statues in the Thomson Reuters Checkpoint database and the data since 2006 are from Lincoln Institute of Land Policies. The data on real estate transfer tax rates are missing for 13 states in 1996 and one state in 1999 due to

[3]We are grateful to Frederico Belo for sharing the data.

[4]The definition is available in Appendix C of the Dictionary of Occupational Titles (U.S. Department of Labor, 1991).

incomplete information. The summary statistics for each state-level variable is presented in Table 3.1.

3.3.5 Control Variables

In the analysis, we include the firm-level control variables following the literature in risk management. We first control for basic firm-level characteristics, *Log(Sales)*, *Tangibility*, and *ROA*. *ROA* is defined as operating income before depreciation divided by total assets. Following Purnanandam (2008), we control for the non-monotonic relationship between financial leverage and corporate risk management. In particular, we include *Book Leverage* and *Square of Book Leverage*. *Book Leverage* is defined as total debt divided by the sum of total debt and book equity. If book equity is negative, we set *Book Leverage* as missing. If the calculated leverage ratio is larger than one, we set it as one. We further control for a firm's growth option and R&D expenses. We use *Market to Book* to measure the growth option, and *R&D* is defined as the ratio of R&D expense to total assets. If the R&D expense is missing, we set it as zero but include a dummy variable *R&D Missing*, equal to one if the R&D expense is missing in Compustat and zero otherwise, in the analysis. Following Almeida et al. (2016), we control for corporate liquidity, *Quick Ratio* and operational hedging, *Cash Holding*, *Inventory*, and *Trade Credit*. The tax-related variables are also included following Graham and Smith (1999) and Purnanandam (2008). Specifically, we include *Tax Convexity* and *Non-debt Tax Shield*. *Tax Convexity* is calculated using the coefficients in Graham and Smith (1999), and *Non-debt Tax Shield* is defined as depreciation divided by total assets. *Foreign Sales* is also controlled, since it would have a direct impact on the use of foreign currency derivative hedging. All the control variables are winsorized at the 1% and 99% percentiles to mitigate the effects of outliers. Variable definitions and data sources are available in Appendix A.1 and the summary statistics are reported in Table 3.1. In the final sample, we require that the data on corporate risk management, firm-level unionization dummy and control variables are not missing. The sample includes 30,959 firm-year observations and spans from fiscal year 1996 to 2013.

3.4 Labor Protection and Corporate Derivative Hedging

In this section, we examine the effect of labor adjustment costs arising from labor market institutions on the corporate derivative hedging policy. We exploit two empirical settings: labor unionization and employment protections provided by WDLs. In Sections 4.1-4.3, we present evidence on the relation between labor unionization and corporate derivative hedging. In Section 4.4, we present evidence on how the labor protections provided by WDLs affect corporate derivative hedging.

3.4.1 Unionization and Corporate Hedging: OLS Estimations

In this subsection, we present the effect of firm-level union power on corporate derivative hedging. In particular, we estimate the following equation:

$$Hedging_{ijt} = \alpha + \beta UnionPower_{it} + \gamma X_{it} + \eta_j + \mu_t + \epsilon_{ijt} \tag{3.13}$$

$Hedging_{ijt}$ measures corporate derivative hedging and is equal to *Hedging Dummy* or *# of Mentions* for firm i in industry j and year t. $UnionPower_{it}$ measures firm-level union power and is equal to the unionization dummy or union coverage rate for firm i in year t. X_{it} is a vector of firm-level characteristics including firm size, tangibility, ROA, market-to-book ratio, book leverage, square of book leverage, quick ratio, R&D, modified Zscore, cash holding, inventory, trade credit, non-debt tax shield, tax convexity, and foreign sales. η_j and μ_t are three-digit SIC and year fixed effects, respectively, and ϵ_{ijt} is the error term. Standard errors are robust and clustered at the firm level.

The estimations based on Equation (3.13) are presented in Table 3.2. We use the unionization dummy and union coverage rate to measure firm-level union power in Panels A and B, respectively. In each panel, the dependent variable is *Hedging Dummy* in columns (1)-(3) and is *# of Mentions* in columns (4)-(6). In Panel A, column (1), we include SIC3 and year fixed effects but do not control for firm-level characteristics. The estimation shows that compared with non-unionized firms, unionized firms are 16.8% more likely to engage in corporate derivative hedging for risk management. In column (2), we further control for firm-level characteristics, and the estimation on the unionization dummy is still positive and statistically significant. In column (3), we estimate a more stringent specification by including SIC3 × Year and State × Year fixed effects to address the concern that firms' derivative hedging could be driven by unobservable time-varying industry or state characteristics. The result shows that compared with non-unionized firms, unionized firms are 7.9% more likely to use derivative contracts to manage foreign currency or commodity price risk, a 14.5% increase relative to the sample mean.

The results in columns (4)-(6) show that unionized firms also mention derivative hedging activities more times in annual reports. In particular, based on the estimation in column (6), unionized firms discuss foreign currency or commodity price derivative hedging in 10-Ks 0.72 more times compared with non-unionized firms, a 29.6% increase relative to the sample mean. The results in Panel B are qualitatively similar to the ones in Panel A and are all statistically significant, suggesting that our results are robust to alternative measures for firm-level union power.

Overall, the results in Table 3.2 show that firm-level union power is positively associated with both extensive and intensive margins of corporate derivative hedging. However, since

firm-level union power is not randomly assigned, the documented relationship could be due to sample selections. In order to mitigate such concerns, we implement a propensity score matching method and also exploit a quasi-natural experiment in the following two subsections.[5]

3.4.2 Unionization and Corporate Hedging: Propensity Score Matching

In this subsection, we employ a propensity score matching procedure to mitigate the sample selection concerns. This methodology allows us to identify a sample of control firms that are non-unionized and that do not show systematic differences in observable firm characteristics from those of unionized firms, except for unionization status.

We implement the procedure as follows. We first calculate the probability of being unionized as a function of firm characteristics. Specifically, the propensity score is estimated using a logistic regression based on the same firm characteristics used in Table 3.2. In the second step, we match each observation of a unionized firm with observations of non-unionized firms in the same calendar year and SIC3 industry. In order to make sure that identified non-unionized firms are sufficiently similar to the unionized ones, we require that the difference between the estimated propensity scores of non-unionized and unionized firms does not exceed 0.1% in absolute value.

Before reporting our estimation results, we verify the identification assumptions for matching estimations. We first test the conditional independence assumption (CIA) and the results are presented in Panel A of Table 3.3. The results show that in the matched sample, there is little difference in the observable firm characteristics between unionized and non-unionized firms. Overall, the results indicate that the CIA is unlikely to be violated. The other identification assumption is the overlapping assumption. In order to test whether this assumption holds in our sample, we plot the histograms of estimated propensity scores for treated and untreated firms in Figure 3.2. The result shows that the degree of overlap in the distributions of estimated propensity scores for treated and untreated firms is substantial and therefore the overlapping assumption is unlikely to be violated as well.

In Panel B of Table 3.3, we present the matching estimations. The comparison between the mean of hedging measures between matched unionized and non-unionized firms shows that unionized firms engage in more corporate derivative hedging activities. In particular, the results show that compared with non-unionized firms, unionized firms are 12.4% more

[5]A popular method in drawing causal inference on the effects of unionization is to use the information on the NLRB labor union election and utilize a regression discontinuity design (DiNardo and Lee, 2004). Intuitively, we can compare the post-election changes in corporate hedging in firms in which unions barely win the elections with the value in firms in which unions barely lose the elections. However, the corporate hedging measures developed in our paper do not have large enough within firm variation to allow us to identify statistically significant effects in this empirical setting.

likely (a 22.7% increase relative to the sample mean) to use foreign currency or commodity hedging and discuss derivative hedging in 10-Ks 0.81 more times (a 33.3% increase relative to the sample mean). Overall, the results in Table 3.3 are consistent with the OLS estimations and indicate that the documented positive relationship between firm-level union power and corporate derivative hedging in Table 3.2 is not due to differences in observable firm characteristics.

3.4.3 Unionization and Corporate Hedging: Evidence from RTW Laws

In this subsection, we present further evidence regarding the relationship between union power and corporate derivative hedging. The estimations in the previous sections are still subject to endogeneity concerns, since matching estimations do not rely on exogenous shocks and we cannot control for unobservable firm characteristics. In order to mitigate such concerns, we exploit the fact that Oklahoma, Indiana, and Michigan adopted the RTW laws at different time in our sample period and employ a DiD method to estimate the causal effects.

The RTW law is legislation that prevents union shop. In states with RTW laws, employees in workplaces with CBAs are not required to pay union dues even though they can receive the benefits of collective bargaining. Such a law therefore creates free-rider problems for unions, which makes them less economically attractive to workers to join unions. The combination of reduced financial support and workers' unwillingness to join unions diminishes unions' ability to organize strikes (Ellwood and Glenn, 1987). This effect has important implications for unions' bargaining position relative to employers, since the ability to organize strikes grants unions much bargaining power.[6]

To estimate the effect, we use the following equation:

$$Hedging_{ijst} = \alpha + \beta RTW_{st} + \gamma_1 X_{it} + \gamma_2 Z_{st} + \mu_i + \eta_{jt} + \epsilon_{it} \tag{3.14}$$

The RTW_{st} dummy is equal to one if state s has adopted the RTW law in year t and zero otherwise. X_{it} and Z_{st} are vectors of firm-level and state-level characteristics, and α_i and η_{jt} are firm and SIC3×Year fixed effects, respectively. Standard errors are robust and clustered at the state level. The estimated β represents the effect of the adoption of RTW law on the corporate derivative hedging in firms headquartered in affected states relative to all firms in the same 3-digit SIC industry in the unaffected states.

[6]The states that have adopted RTW laws as of 2014 are: Alabama (1953), Arizona (1947), Arkansas (1947), Florida (1943), Georgia (1947), Idaho (1985), Indiana (2012), Iowa (1947), Kansas (1958), Louisiana (1976), Michigan (2013), Mississippi (1960), Nebraska (1947), Nevada (1952), North Carolina (1947), North Dakota (1948), Oklahoma (2001), South Carolina (1954), South Dakota (1947), Tennessee (1947), Texas (1993), Utah (1955), Virginia (1947), Wyoming (1963).

Table 3.4 presents the DiD estimations. The dependent variable in column (1) is *Hedging Dummy*, which is a dummy variable equal to one if a firm mentions at least one time about foreign currency or commodity hedging in the annual report and zero otherwise. The result shows that after the adoption of the RTW law, the probability to mention derivative hedging in 10-Ks decreases in affected firms even through the estimation is not statistically significant. In columns (2)-(4), we use # *Mentions*, which is the number of mentions about foreign currency or commodity hedging in the annual report, as the dependent variable. In column (2), we do not control firm-level or state-level characteristics and the results suggest that compared with all firms in the same 3-digit SIC industry in unaffected states, the affected firms mention 0.30 fewer times about currency or commodity hedging activities in 10-Ks, a 12.2% decreases relative to the sample mean, after the adoptions of the RTW laws in the headquarters states. In column (3), we further control additional firm-level and state-level characteristics and the estimation on the RTW dummy is still negative and significant. In column (4), we further explore the dynamic effects of the adoption of the RTW on corporate derivative hedging. In particular, RTW^{3-}, RTW^{-2}, RTW^{0}, RTW^{+1}, RTW^{+2}, and RTW^{3+} are dummy variables that equal to one if the differences between a firm's fiscal end year and the year of RTW adoption are less than or equal to minus 3, equal to minus two, equal to zero, equal to one, equal to two, and larger than or equal to three and zero otherwise. The estimations show that the coefficients on RTW^{3-} and RTW^{-2} are insignificant and suggest that the parallel trends assumption is more likely to be satisfied in our sample. The coefficients on RTW^{0} and RTW^{+1} are also negative and insignificant, suggesting that the effects are not immediate and the coefficients on RTW^{+2} and RTW^{3+} are negative and significant. The estimations imply that a firm's corporate hedging activities decrease significantly two years and beyond after the adoption of the RTW law relative to the hedging activities one year before the adoption. Overall, the results in Table 3.4 suggest that the adoption of RTW law has significant effects on corporate hedging and further strengthen the interpretation that the incentive to manage risk associated with labor adjustment costs is one driving force for the corporate hedging policy.

3.4.4 Wrongful Discharge Laws and Corporate Hedging

In this subsection, we examine how increases in firing costs arising from labor protections provided by WDLs affect corporate derivative hedging. The WDLs restrict employers' abilities to fire employees at will and has three common law exceptions to the at-will employment doctrine: the good faith exception, the implied contract exception, and the public policy exception. A majority of U.S. states adopted one or more exceptions during the 1970s, 1980s,

and early 1990s. Louisiana was the last state that adopted WDLs, and the good faith exception was adopted by Louisiana in January 1998. By 1999, 11 states had adopted the good faith exception, 41 states had adopted the implied contract exception, and 43 states had adopted the public policy exception. Autor, Donohue, and Schwab (2003) provide details on the definitions and legal significance of each common law exception. Since employers in states that adopted WDLs cannot fire employees without good cause, employers' firing costs have increased. This provides a good opportunity to study the effect of labor adjustment costs on corporate derivative hedging.

Our identification strategy explores corporate headquarters relocations as plausibly exogenous shocks to the extent to which firms are constrained by common law exceptions in WDLs.[7] The identification strategy would be invalid if firms relocated headquarters states in order to relax the constraints imposed by WDLs. However, we are not aware of any systematic evidence showing that this is the first-order reason for corporate headquarters relocations. Moreover in our sample, there are 153 (158) firms moving to states that recognized more (less) common law exceptions to the at-will employment doctrine than the previous headquarters. Therefore, there is no systematic patterns showing that firms relocate headquarters just because they want to relax the constraints imposed by WDLs. In particular, we estimate the following generalized DiD specification:

$$Hedging_{ijst} = \alpha + \beta WDLIndex_{it} + \gamma_1 X_{it} + \gamma_2 Z_{it} + \mu_i + \eta_{jt} + \epsilon_{ijst} \tag{3.15}$$

WDL Index$_{it}$ is equal to the total number of common law exceptions recognized by firm i's headquarters state in year t and varies between 0 and 3. X_{it} and Z_{st} are vectors of firm-level and state-level controls, and μ_i and η_{jt} are firm and SIC3×Year fixed effects, respectively. Robust standard errors are clustered at the firm level. The variation in a firm's *WDL Index* comes from the corporate headquarters relocation and is time-invariant if the firm does not move its headquarters during the sample period or the new headquarters state has adopted the same number of common law exceptions as the previous headquarters state.

Table 3.5 presents the results.[8] The estimations show that firms facing additional at-will employment constraints engage more in derivative hedging activities to manage foreign currency or commodity price risk. In particular, when a firm moves to a state that adopted one more common law exception in WDLs than the previous headquarters state, the firm is 3.4% more likely (a 6.2% increase relative to the sample mean) to use foreign currency or commodity derivative hedging contracts. Furthermore, the firm also discusses derivative hedging activities in the 10-Ks 0.24 more times (a 10.0% increase relative to the sample

[7] Firms' historical headquarters states are extracted from corporate 10-K filings.

[8] The WDL index is not available for firms headquartered in D.C. (107 observations) and therefore the number of observations in Table 3.5 is different from the one in Table 3.2.

mean). Overall, the estimations in Table 3.5 suggest that firms actively engage in more risk management activities when labor force adjustments are more costly.

3.5 Labor Skill Reliance and Corporate Derivative Hedging

In previous sections, we estimate the effect of labor adjustment costs arising from labor market institutions on corporate derivative hedging. However, labor adjustment costs could also arise from the nature of human capital. In particular, employees with higher skills are associated with higher labor adjustment costs (Oi, 1962; Ochoa, 2013). In this section, we investigate how labor adjustment costs arising from this channel affect corporate derivative hedging and present suggestive evidence.

In order to measure firms' reliance on skilled labor, we follow the literature in asset pricing and use the industry-level labor skill level measures in Belo et al. (2016). Specifically, we are interested in examining whether firms in industries that rely more on skilled labor engage in more corporate derivative hedging. Specifically, we estimate the following equation:

$$Hedging_{ijst} = \alpha + \beta SkillLevel_{jt} + \gamma X_{it} + \eta_{st} + \epsilon_{ijst} \tag{3.16}$$

$SkillLevel_{jt}$ measures the fraction of high-skilled labor in industry j and year t. X_{it} is a vector of firm-level characteristics, and η_{st} are State $\times$ Year fixed effect. The inclusion of State $\times$ Year fixed effect effectively controls omitted time-varying variables at the state level. Since time-series variation in $SkillLevel_{jt}$ is small in each industry, we do not control for firm or industry fixed effects in the analysis. Robust standard errors are clustered at the industry level for which the skill measure is defined.

The results are presented in Table 3.6.[9] The dependent variable is *Hedge Dummy* in Panel A and is *# Mentions* in Panel B. The estimations in column (1) in both panels show that firms in industries that rely more on skilled labor engage in more derivative hedging activities. In particular, the estimations show that a one-standard-deviation increase in the skill measure is associated with a 1.7% increase (a 3.0% increase relative to the sample mean) in the probability of using foreign currency or commodity derivative hedging contracts. Moreover, a firm also discusses foreign currency or commodity derivative contracts in 10-Ks 0.18 more times (a 7.5% increase relative to the sample mean) in 10-Ks when the skill measure increases one standard deviation.

We further investigate whether labor mobility or the inalienable nature of human capital is the channel through which labor adjustment costs affect corporate hedging. If skilled employees are restricted from leaving their firms, then the associated labor adjustment costs in

[9]The industry-level labor skill measure is not available for 962 observations and therefore the number of observations in Table 3.6 is different from the one in Table 3.2.

hiring and firing would disappear, and we would not expect to observe any relation between a firm's reliance on skilled labor and corporate derivative hedging. However, since firms do not have ownership of employees' human capital, employees can freely leave the current company and join or form other companies if no institutional restrictions are imposed. It is labor mobility that drives the relation between labor adjustment costs, arising from firms' reliance on skilled labor, and corporate derivative hedging. As a result, we expect firms to engage in fewer derivative hedging activities if the mobility of skilled employees is restricted.

To test this conjecture, we exploit three state policies that restrict labor mobility: the enforcement levels of non-compete agreements at the state level, the adoptions of the IDD by state courts, and the transfer tax rates on the residential real estate transactions at the state level. In particular, we investigate whether firms that rely on more skilled labor use fewer derivative contracts for hedging when the mobility of skilled labor is more restricted in headquarters states and estimate the following equation:

$$\begin{aligned} Hedging_{ijst} = \alpha + \beta SkillLevel_{jt} \times LaborMobility_{st} + \\ \beta_1 SkillLevel_{jt} + \gamma X_{it} + \eta_{st} + \epsilon_{ijst} \end{aligned} \tag{3.17}$$

$LaborMobility_{st}$ represents the state-level policy that restricts skilled labor's mobility. Robust standard errors are two-way clustered at the industry and state level.

The results for the enforcement of non-compete agreements are presented in column (2) in each panel. We are interested in the estimated coefficient on the interaction term $SkillLevel_{jt} \times NCIndex_{st}$. The results show that the effect of skilled labor reliance on corporate derivative hedging is still positively significant; however, the effect is attenuated when enforcement levels of non-compete covenants are higher in headquarters states. In particular, when the non-compete covenant enforcement index increases from the 25th percentile (a value equal to 3) to the 75th percentile (a value equal to 6) in the sample, the effects of a one-standard-deviation increase in the skill level measure at the industry level on derivative hedging probability and the number of mentions about derivative hedging activities in 10-Ks are reduced by 0.7% (a 1.4% decrease relative to the sample mean) and 0.06 times (a 2.5% decrease relative to the sample mean), respectively.

The results in columns (3) and (4) in Panels A and B present the results for the adoptions of IDD and the real estate transfer tax rates, respectively. The estimations also show that a firm's sensitivity of corporate hedging to skilled labor reliance is reduced when labor mobility is more restricted in its headquarters state. Overall, the estimations in Table 3.6 support the view that labor mobility is one channel through which labor adjustment costs, or the extent to which a firm relies on skilled labor, affect the corporate hedging policy.

3.6 Conclusion

In this paper, we study the effect of labor adjustment costs on corporate risk management. The presence of labor adjustment costs reduces a firm's ability to smooth cash flows, especially during economic downturns, and generates risk for equity holders. As a consequence, this creates incentives for corporate risk management.

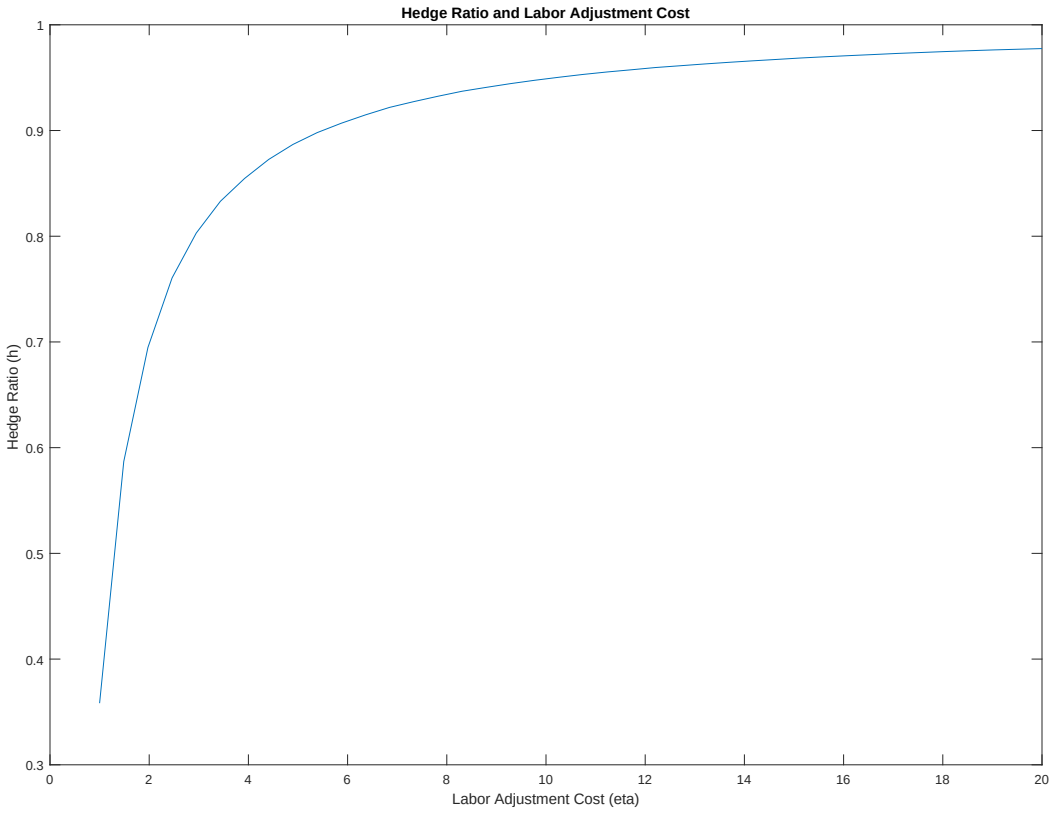
We find that firms in which labor forces are more costly to adjust use more derivative contracts to manage risk. In particular, we show that firms in which union power is stronger use more derivative contracts to hedge foreign currency or commodity price risk. Furthermore, we also find that firms that move to headquarters states that recognized more common law exceptions in WDLs engage in more risk management activities.

We further find that firms in industries that rely more on high-skilled employees use more derivative contracts for risk management. Further evidence suggests that the effect of skilled labor reliance on corporate derivative hedging is attenuated when the mobility of skilled labor is more restricted in the headquarters states, suggesting that labor mobility is one channel through which skilled labor reliance affects corporate risk management.

By establishing the relation between labor adjustment costs and corporate risk management, this paper shows that labor market frictions have important implications for corporate policies.

Figure 3.1: Labor Adjustment Costs and Optimal Hedging Position

This figure shows the relation between hedging and labor adjustment costs when $f(l) = l^{\alpha}$ and the cost function is quadratic.



Parameters: $\alpha_0 = 1$, $\alpha = 0.67$, $c = 1$, $\bar{W} = 0.05$, $\omega_0 = 0.5$

Figure 3.2: Histogram of Estimated Propensity Score for Unionized and Non-unionized Firms

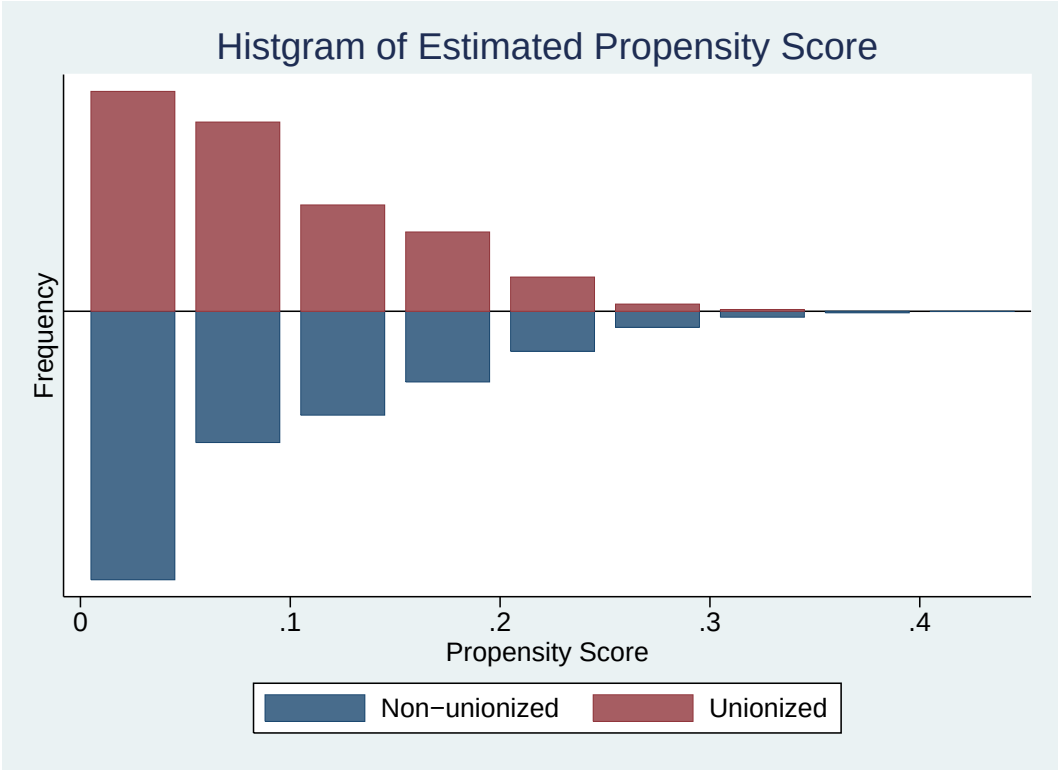


Table 3.1: Summary Statistics

This table presents the summary statistics for the variables in the paper. All data sources and variable definitions are available in Appendix A.1.. The summary statistics for *Industry-level Labor Skill* are based on industry-year observations. The summary statistics for the state-level variables, *Non-compete Enforcement*, *IDD*, and *Real Estate Transfer Tax Rate*, are based on state-year observations.

	N	Mean	P25	Median	P75	Std.Dev.
Hedging Dummy	30,959	0.547	0.000	1.000	1.000	0.498
# of Mentions	30,959	2.440	0.000	1.000	3.000	3.844
Unionization	30,959	0.095	0.000	0.000	0.000	0.293
Union Coverage Rate	29,691	0.015	0.000	0.000	0.000	0.083
Log(Sales)	30,959	5.113	3.620	5.103	6.600	2.121
Tangibility	30,959	0.226	0.081	0.168	0.313	0.192
ROA	30,959	0.079	0.047	0.111	0.166	0.167
Market to Book	30,959	2.023	1.136	1.531	2.266	1.539
Book Leverage	30,959	0.280	0.034	0.247	0.449	0.249
Quick Ratio	30,959	1.169	0.140	0.468	1.330	1.874
R&D	30,959	0.054	0.000	0.016	0.077	0.083
Modified Zscore	30,959	1.093	0.730	1.699	2.488	2.833
Cash Holding	30,959	0.187	0.034	0.110	0.278	0.199
Non-debt Tax Shield	30,959	0.045	0.025	0.038	0.056	0.030
Tax Convexity	30,959	0.119	0.001	0.008	0.052	0.425
Inventory	30,959	0.223	0.059	0.182	0.314	0.217
Trade Credit	30,959	0.085	0.037	0.066	0.108	0.074
Foreign Sales	30,959	0.374	0.105	0.299	0.555	0.333
Industry-level Labor Skill	3,270	0.201	0.095	0.156	0.257	0.154
Non-compete Enforcement	430	4.449	3.000	5.000	6.000	1.816
IDD	877	0.375	0.000	0.000	1.000	0.484
Real Estate Transfer Tax Rate	863	0.536	0.010	0.300	0.700	0.711

Table 3.2: Hedging and Labor Adjustment Costs: OLS Estimations

This table presents the effect of firm-level union power on corporate financial hedging using OLS regressions. *Hedging Dummy* is a dummy variable equal to one if a firm mentions at least one time about foreign currency or commodity hedging in the annual report. *# Mentions* is the number of mentions about foreign currency or commodity hedging in the annual report. We use a unionization dummy and union coverage rate to measure firm-level union power in Panels A and B, respectively. *Unionized* is a dummy variable equal to one if a firm mentions that some fraction of employees are covered by collective bargaining agreements. *Union Coverage* is the percentage of a firm's employees that are covered by collective bargaining agreements. We control firm characteristics including firm size, tangibility, ROA, market-to-book ratio, book leverage, square of book leverage, quick ratio, R&D, modified Zscore and cash holding, non-debt tax shield, tax convexity, inventory, trade credit, and foreign sales. Robust standard errors are clustered at the firm level. ***, **, and * represent significance at 1%, 5% and 10% levels, respectively.

	Panel A: Unionization Dummy					
	Hedging Dummy			# of Mentions		
	(1)	(2)	(3)	(4)	(5)	(6)
Unionized	0.168***	0.093***	0.079***	1.460***	0.800***	0.715***
	[0.015]	[0.013]	[0.014]	[0.160]	[0.136]	[0.152]
Log(Sales)		0.088***	0.088***		0.829***	0.857***
		[0.003]	[0.004]		[0.029]	[0.033]
Tangibility		0.019	0.017		0.251	0.243
		[0.038]	[0.042]		[0.286]	[0.321]
ROA		-0.124***	-0.129***		-0.272	-0.333
		[0.035]	[0.038]		[0.212]	[0.238]
Market to Book		0.001	0.001		0.024	0.029
		[0.003]	[0.003]		[0.019]	[0.022]
Book Leverage		0.147***	0.138**		0.786*	0.799*
		[0.053]	[0.057]		[0.425]	[0.466]
Square of Book Leverage		-0.105*	-0.097		-0.780	-0.787
		[0.062]	[0.067]		[0.506]	[0.554]
Quick Ratio		-0.014***	-0.014***		-0.089***	-0.083***
		[0.004]	[0.004]		[0.022]	[0.024]
R&D		0.092	0.112		-0.127	-0.009
		[0.076]	[0.081]		[0.544]	[0.582]
R&D Missing		-0.047***	-0.040***		-0.527***	-0.428***
		[0.013]	[0.015]		[0.091]	[0.101]
Modified Zscore		0.003	0.004		-0.001	0.010
		[0.002]	[0.003]		[0.015]	[0.017]
Cash Holding		0.151***	0.126***		0.933***	0.689**
		[0.040]	[0.043]		[0.286]	[0.303]
Non-debt Tax Shield		0.089	-0.011		-0.948	-0.635
		[0.163]	[0.175]		[1.086]	[1.197]
Tax Convexity		0.018*	0.019*		0.627***	0.678***
		[0.011]	[0.012]		[0.053]	[0.060]
Inventory		0.042	0.032		0.570***	0.544**
		[0.026]	[0.027]		[0.204]	[0.224]
Trade Credit		-0.192***	-0.197***		-1.220**	-1.029*
		[0.067]	[0.073]		[0.535]	[0.583]
Foreign Sale		0.170***	0.177***		1.431***	1.481***
		[0.015]	[0.016]		[0.113]	[0.124]
SIC3 & Yr. FE	Y	Y	N	Y	Y	N
SIC3×Year & State×Year FE	N	N	Y	N	N	Y
R^2	0.094	0.211	0.297	0.105	0.265	0.347
N	30959	30959	30959	30959	30959	30959

	Panel B: Union Coverage Rate					
	Hedging Dummy			# of Mentions		
	(1)	(2)	(3)	(4)	(5)	(6)
Union Coverage	0.350***	0.163***	0.165***	2.895***	1.350***	1.439***
	[0.052]	[0.047]	[0.048]	[0.584]	[0.511]	[0.533]
Log(Sales)		0.087***	0.089***		0.813***	0.834***
		[0.003]	[0.003]		[0.029]	[0.031]
Tangibility		0.027	0.050		-0.101	0.058
		[0.037]	[0.038]		[0.281]	[0.296]
ROA		-0.130***	-0.131***		-0.269	-0.359
		[0.035]	[0.037]		[0.216]	[0.229]
Market to Book		-0.000	-0.000		0.011	0.012
		[0.003]	[0.003]		[0.019]	[0.021]
Book Leverage		0.141**	0.127**		0.711	0.745*
		[0.055]	[0.056]		[0.438]	[0.453]
Square of Book Leverage		-0.080	-0.064		-0.684	-0.760
		[0.064]	[0.065]		[0.523]	[0.541]
Quick Ratio		-0.017***	-0.017***		-0.114***	-0.112***
		[0.004]	[0.004]		[0.023]	[0.024]
R&D		0.041	0.039		-0.331	-0.509
		[0.076]	[0.079]		[0.543]	[0.553]
R&D Missing		-0.053***	-0.045***		-0.642***	-0.564***
		[0.013]	[0.014]		[0.097]	[0.101]
Modified Zscore		0.003	0.003		-0.004	0.005
		[0.002]	[0.003]		[0.016]	[0.017]
Cash Holding		0.165***	0.155***		1.034***	0.855***
		[0.040]	[0.041]		[0.298]	[0.302]
Non-debt Tax Shield		0.078	0.004		-0.722	-0.252
		[0.163]	[0.168]		[1.091]	[1.115]
Tax Convexity		0.024**	0.026**		0.621***	0.667***
		[0.011]	[0.011]		[0.055]	[0.058]
Inventory		0.048*	0.048*		0.556***	0.556***
		[0.026]	[0.026]		[0.208]	[0.214]
Trade Credit		-0.202***	-0.182***		-1.726***	-1.586***
		[0.067]	[0.069]		[0.562]	[0.590]
Foreign Sale		0.171***	0.175***		1.465***	1.465***
		[0.015]	[0.016]		[0.115]	[0.119]
SIC3 & Yr. FE	Y	Y	N	Y	Y	N
SIC3×Year & State×Year FE	N	N	Y	N	N	Y
R^2	0.054	0.184	0.234	0.054	0.231	0.277
N	29691	29691	29691	29691	29691	29691

Table 3.3: Unionization and Corporate Hedging: Propensity Score Matching

In this table we implement a propensity score matching procedure and match each observation of a unionized firm with observations of non-unionized firms in the same calendar year and SIC3 industry based on the propensity score estimated using all contemporaneous firm-level characteristics as in Table 3.2. *Hedging Dummy* is a dummy variable equal to one if a firm mentions at least one time about foreign currency or commodity hedging in the annual report. *# Mentions* is the number of mentions about foreign currency or commodity hedging in the annual report. Panel A tests the conditional independence assumption, and Panel B presents the average treatment effects. We require that the propensity score difference between unionized and matched non-unionized firms does not exceed 0.1% in absolute value. The estimations represent the difference of *Hedging Dummy* and *# Mentions* between the two groups.

Panel A: Conditional Independence Assumption

	Unionized	Non-unionized	T-stat	P-value
Log(Sales)	5.520	5.369	1.14	0.253
Tangibility	0.221	0.234	-1.05	0.295
ROA	0.099	0.098	0.22	0.822
Market to Book	1.909	1.830	0.86	0.390
Book Leverage	0.282	0.271	0.62	0.537
Square of Book Leverage	0.134	0.119	1.20	0.229
Quick Ratio	0.938	0.971	-0.31	0.755
R&D	.0614	0.065	-0.600	0.549
Modified Zscore	1.241	1.387	-0.89	0.372
Cash Holding	0.163	0.173	-0.85	0.394
Non-debt Tax Shield	0.049	0.048	0.40	0.690
Tax Convexity	0.045	0.042	0.25	0.804
Inventory	0.244	0.247	-0.19	0.848
Trade Credit	0.087	0.082	0.97	0.331
Foreign Sale	0.440	0.401	1.56	0.119

Panel B: Average Treatment on Treated (ATT) and Caliper=0.1%

	Obs.	Mean	Difference	T-stat
Hedging Dummy(Unionized)	700	0.723	0.124	3.48
Hedging Dummy(Non-unionized)		0.600		
# Mentions(Unionized)	700	4.218	0.808	2.05
# Mentions(Non-unionized)		3.410		

Table 3.4: Evidence from RTW Law

This table presents the effect of RTW law adoptions on corporate derivative hedging. *Hedging Dummy* is a dummy variable equal to one if a firm mentions at least one time about foreign currency or commodity hedging in the annual report and zero otherwise. *# Mentions* is the number of mentions about foreign currency or commodity hedging in the annual report. *RTW* is a dummy variable equal to one if a firm is headquartered has adopted RTW in a year and zero otherwise. RTW^{3-}, RTW^{-2}, RTW^{0}, RTW^{+1}, RTW^{+2}, and RTW^{3+} are dummy variables that equal to one if the differences between a firm's fiscal end year and the year of RTW adoption are less than or equal to minus 3, equal to minus two, equal to zero, equal to one, equal to two, and larger than or equal to three and zero otherwise. In all estimations, we control for firm-level and state-level characteristics. Firm and SIC3×Year fixed effects are included in all estimations. All standard errors are robust and clustered at the state level. ***, **, and * represent significance at 1%, 5% and 10% levels, respectively.

	Hedging Dummy	# of Mentions		
	(1)	(2)	(3)	(4)
RTW	-0.026	-0.296**	-0.326**	
	[0.030]	[0.129]	[0.130]	
RTW^{3-}				-0.156
				[0.293]
RTW^{-2}				-0.719
				[0.528]
RTW^{0}				-0.378
				[0.290]
RTW^{+1}				-0.127
				[0.394]
RTW^{+2}				-1.149***
				[0.281]
RTW^{3+}				-0.388**
				[0.163]
Log(Sales)	0.065***		0.680***	0.681***
	[0.015]		[0.095]	[0.094]
Tangibility	0.062		-0.037	-0.042
	[0.069]		[0.439]	[0.438]
ROA	-0.076*		-0.214	-0.212
	[0.045]		[0.199]	[0.199]
Market to Book	-0.002		0.016	0.016
	[0.003]		[0.019]	[0.019]
Book Leverage	0.008		-0.105	-0.109
	[0.096]		[0.411]	[0.411]
Square of Book Leverage	0.044		0.196	0.201
	[0.113]		[0.436]	[0.437]
Quick Ratio	-0.001		0.018	0.018
	[0.005]		[0.018]	[0.018]
R&D	-0.158		0.445	0.444
	[0.138]		[0.716]	[0.716]
R&D Missing	-0.044		-0.436**	-0.435**
	[0.030]		[0.196]	[0.196]
Modified Zscore	0.001		-0.034*	-0.034*
	[0.002]		[0.018]	[0.018]
Cash Holding	-0.092		-0.261	-0.263
	[0.059]		[0.465]	[0.466]
Non-debt Tax Shield	0.114		-0.377	-0.361
	[0.179]		[1.438]	[1.450]
Tax Convexity	0.050***		0.481***	0.481***
	[0.017]		[0.077]	[0.078]
Inventory	0.007		0.320	0.320
	[0.024]		[0.220]	[0.220]
Trade Credit	-0.136		-0.789*	-0.796*
	[0.134]		[0.457]	[0.454]
Foreign Sale	0.066***		0.319**	0.321**
	[0.018]		[0.157]	[0.157]
Per Capita GDP Growth	0.219		3.024**	3.093**
	[0.207]		[1.204]	[1.242]
Employment Rate	-0.373***		-2.906**	-2.959**
	[0.128]		[1.217]	[1.228]
Firm FE	Y	Y	Y	Y
SIC3×Year FE	Y	Y	Y	Y
R^2	0.593	0.612	0.616	0.616
N	30959	30959	30959	30959

Table 3.5: Evidence from Wrongful Discharge Laws

This table presents the effect of wrongful discharge law on corporate derivative hedging. *WDL Index*$_{it}$ is the total number of common law exceptions recognized by a firm's headquarters state. *Hedging Dummy* is a dummy variable equal to one if a firm mentions at least one time about foreign currency or commodity hedging in the annual report. *# Mentions* is the number of mentions about foreign currency or commodity hedging in the annual report. All regressions include firm-level and state-level controls. Firm and SIC3×Year fixed effects are also included in all regressions. Robust standard errors are clustered at the firm level. ***, **, and * represent significance at 1%, 5% and 10% levels, respectively.

	Hedging Dummy	# of Mentions
WDL Index	0.034**	0.243**
	[0.017]	[0.113]
Log(Sales)	0.063***	0.673***
	[0.011]	[0.089]
Tangibility	0.070	-0.021
	[0.058]	[0.404]
ROA	-0.074*	-0.188
	[0.041]	[0.239]
Market to Book	-0.002	0.014
	[0.003]	[0.023]
Book Leverage	0.007	-0.114
	[0.059]	[0.455]
Square of Book Leverage	0.042	0.194
	[0.069]	[0.538]
Quick Ratio	-0.001	0.018
	[0.004]	[0.021]
R&D	-0.158	0.416
	[0.107]	[0.650]
R&D Missing	-0.048**	-0.451**
	[0.023]	[0.178]
Modified Zscore	0.001	-0.034*
	[0.003]	[0.019]
Cash Holding	-0.093*	-0.275
	[0.048]	[0.318]
Non-debt Tax Shield	0.115	-0.318
	[0.196]	[1.125]
Tax Convexity	0.050***	0.481***
	[0.017]	[0.085]
Inventory	0.005	0.316
	[0.033]	[0.201]
Trade Credit	-0.160	-0.843
	[0.101]	[0.641]
Foreign Sale	0.067***	0.323**
	[0.018]	[0.144]
Per Capita GDP Growth	0.192	2.813**
	[0.159]	[1.110]
Employment Rate	-0.566	-0.730
	[0.364]	[2.637]
Firm	Y	Y
SIC3×Year FE	Y	Y
R^2	0.594	0.617
N	30852	30852

Table 3.6: Hedging and Labor Adjustment Costs: Industry-Level Skill Level

This table presents the effect of the industry-level labor skill level measure on corporate derivative hedging. *Hedging Dummy* is a dummy variable equal to one if a firm mentions at least one time about foreign currency or commodity hedging in the annual report and zero otherwise. *# Mentions* is the number of mentions about foreign currency or commodity hedging in the annual report. *SkillLevel* is the fraction of high-skilled labor in an industry. Industry is defined as three-digit SIC before 2002 and four-digit NAICS since 2002. *Non-Compete Enforcement* is the enforcement index of non-compete agreements at the state-level and the data is available till 2004. *IDD* is a dummy variable equal to one if a state court adopted the Inevitable Disclosure Doctrine and zero otherwise. *Real Estate Transfer Tax* is the transfer tax on residential real estate transactions at the state-level. All estimations include state×year fixed effects. Robust standard errors are two-way clustered at the industry and state level in which the labor skill measure is defined. ***, **, and * represent significance at 1%, 5% and 10% levels, respectively.

	Panel A: Hedge Dummy			
	(1)	(2)	(3)	(4)
SkillLevel	0.108**	0.186**	0.138**	0.147**
	[0.050]	[0.078]	[0.053]	[0.059]
SkillLevel*Non-Compete Enforcement		-0.017*		
		[0.009]		
SkillLevel*IDD			-0.057*	
			[0.031]	
SkillLevel*Real Estate Transfer Tax				-0.069**
				[0.029]
Log(Sales)	0.089***	0.098***	0.089***	0.089***
	[0.003]	[0.004]	[0.003]	[0.004]
Tangibility	0.078	0.083	0.077	0.080
	[0.063]	[0.068]	[0.063]	[0.063]
ROA	-0.109***	-0.077*	-0.109***	-0.110***
	[0.039]	[0.038]	[0.040]	[0.040]
Market to Book	0.000	-0.003	0.000	0.000
	[0.002]	[0.003]	[0.003]	[0.002]
Book Leverage	0.152***	0.105	0.152***	0.151***
	[0.046]	[0.063]	[0.046]	[0.045]
Square of Book Leverage	-0.088*	-0.063	-0.089*	-0.083*
	[0.047]	[0.071]	[0.047]	[0.046]
Quick Ratio	-0.016***	-0.018***	-0.016***	-0.016***
	[0.006]	[0.007]	[0.005]	[0.006]
R&D	0.050	0.159*	0.048	0.046
	[0.082]	[0.081]	[0.082]	[0.083]
R&D Missing	-0.032**	-0.025	-0.032**	-0.032**
	[0.014]	[0.018]	[0.014]	[0.014]
Modified Zscore	0.001	0.002	0.001	0.001
	[0.002]	[0.002]	[0.002]	[0.002]
Cash Holding	0.124**	0.132*	0.123**	0.121**
	[0.056]	[0.074]	[0.056]	[0.055]
Non-debt Tax Shield	-0.129	-0.101	-0.124	-0.139
	[0.157]	[0.135]	[0.156]	[0.154]
Tax Convexity	0.025***	0.045***	0.025**	0.025***
	[0.009]	[0.011]	[0.010]	[0.009]
Inventory	0.074**	0.106**	0.075**	0.072**
	[0.035]	[0.042]	[0.035]	[0.036]
Trade Credit	-0.267***	-0.227**	-0.265***	-0.260***
	[0.085]	[0.099]	[0.084]	[0.085]
Foreign Sale	0.190***	0.261***	0.190***	0.187***
	[0.031]	[0.032]	[0.031]	[0.031]
State×Year FE	Y	Y	Y	Y
R^2	0.197	0.233	0.197	0.196
N	29997	29997	29997	29997

	Panel B: # Mentions			
	(1)	(2)	(3)	(4)
SkillLevel	1.186***	1.375***	1.612***	1.669***
	[0.383]	[0.485]	[0.361]	[0.409]
SkillLevel*Non-Compete Enforcement		-0.133		
		[0.092]		
SkillLevel*IDD			-0.814***	
			[0.251]	
SkillLevel*Real Estate Transfer Tax				-0.791***
				[0.261]
Log(Sales)	0.840***	0.884***	0.838***	0.840***
	[0.058]	[0.067]	[0.056]	[0.058]
Tangibility	0.065	0.070	0.059	0.085
	[0.242]	[0.312]	[0.240]	[0.244]
ROA	-0.273	-0.178	-0.285	-0.295
	[0.209]	[0.157]	[0.210]	[0.219]
Market to Book	0.025	0.010	0.026	0.026
	[0.016]	[0.015]	[0.017]	[0.017]
Book Leverage	1.076***	0.760	1.074***	1.049***
	[0.363]	[0.469]	[0.368]	[0.376]
Square of Book Leverage	-0.946**	-0.802	-0.955**	-0.913**
	[0.411]	[0.542]	[0.417]	[0.426]
Quick Ratio	-0.109***	-0.089**	-0.108***	-0.109***
	[0.030]	[0.034]	[0.030]	[0.030]
R&D	-0.376	0.449	-0.403	-0.436
	[0.512]	[0.554]	[0.514]	[0.509]
R&D Missing	-0.586***	-0.560***	-0.583***	-0.591***
	[0.094]	[0.091]	[0.095]	[0.092]
Modified Zscore	-0.003	0.004	-0.002	-0.002
	[0.021]	[0.017]	[0.020]	[0.020]
Cash Holding	0.549**	0.442	0.533*	0.526*
	[0.267]	[0.309]	[0.274]	[0.267]
Non-debt Tax Shield	-1.890	-0.815	-1.819	-1.960
	[1.402]	[1.413]	[1.397]	[1.434]
Tax Convexity	0.673***	0.753***	0.672***	0.676***
	[0.071]	[0.096]	[0.072]	[0.072]
Inventory	0.942***	1.060***	0.954***	0.955***
	[0.274]	[0.263]	[0.282]	[0.284]
Trade Credit	-2.489***	-2.027***	-2.464***	-2.468***
	[0.649]	[0.636]	[0.645]	[0.659]
Foreign Sale	1.588***	1.811***	1.591***	1.577***
	[0.222]	[0.219]	[0.222]	[0.221]
State×Year FE	Y	Y	Y	Y
R^2	0.249	0.290	0.249	0.248
N	29997	29997	29997	29997

Bibliography

Abraham, K. G., Medoff, J. L., 1984. Length of service and layoffs in union and nonunion work groups. Industrial and Labor Relations Review 38, 87–97.

Aldatmaz, S., Ouimet, P., Van Wesep, E., 2016. The option to quit: The effect of employee stock options on turnover. Journal of Financial Economics forthcoming.

Almeida, H., Hankins, K. W., Williams, R., 2016. Risk management with supply contracts. Review of Financial Studies forthcoming.

Autor, D., Donohue, J. I., Schwab, S., 2003. The costs of wrongful-discharge laws. The Review of Economics and Statistics 88, 211–231.

Baghai, R., Silva, R., Thell, V., Vig, V., 2016. Talent in distressed firms: Investigating the labor costs of financial distress. Working Paper .

Baldwin, C. Y., 1983. Productivity and labor unions: An application of the theory of self-enforcing contracts. The Journal of Business 56, 155–185.

Barreca, A. I., Guldi, M., Lindo, J. M., Waddell, G. R., 2011. Saving babies? revisiting the effect of very low birth weight classification. The Quarterly Journal of Economics 126, 2117–2123.

Belo, F., Lin, X., Bazdresch, S., 2014. Labor hiring, investment, and stock return predictability in the cross section. Journal of Political Economy 122, 129–177.

Belo, F., Lin, X., Li, J., Zhao, X., 2016. Labor-force heterogeneity and asset prices: the importance of skilled labor. Review of Financial Studies forthcoming.

Benmelech, E., Bergman, N. K., 2008. Liquidation values and the credibility of financial contract renegotiation: Evidence from u.s. airlines. Quarterly Journal of Economicsl 123, 1645–167.

Benmelech, E., Bergman, N. K., Enriquez, R. J., 2012. Negotiating with labor under financial distress. Review of Corporate Finance Studies .

Bolton, P., Scharfstein, D. S., 1996. Optimal debt structure and the number of creditors. The Journal of Political Economy 104, 1–25.

Brander, A. J., Lewis, T. R., 1986. Oligopoly and financial structure: The limited liability effect. The American Economic Review 76, 956–970.

Bronars, S. G., Deere, D. R., 1991. The threat of unionization, the use of debt, and preservation of shareholder wealth. The Quarterly Journal of Economics 106, 231–254.

Campbell, J. L., Chen, H., Dhaliwal, D. S., Lu, H.-m., Steele, L. B., 2014. The information content of mandatory risk factor disclosures in corporate filings. Review of Accounting Studies 19, 396–455.

Chen, H. J., Kacperczyk, M., Ortiz-Molina, H., 2011. Do nonfinancial stakeholders affect the pricing of risky debt? evidence from unionized workers. Review of Finance 16, 347–383.

Chetty, R., Sandor, L., Szeidl, A., 2017. The effect of housing on portfolio choice. The Journal of Finance forthcoming.

Chevalier, J. A., 1995a. Capital structure and product-market competition: Empirical evidence from the supermarket industry. The American Economic Review 85, 415–435.

Chevalier, J. A., 1995b. Do lbo supermarkets charge more? an empirical analysis of the effects of lbos on supermarket pricing. The Journal of Finance 50, 1095–1112.

Colla, P., Ippolito, F., Li, K., 2013. Debt specialization. The Journal of Finance 68, 2117–2141.

Corradin, S., Popov, A., 2015. House prices, home equity borrowing, and entrepreneurship. Review of Financial Studies 28, 2399–2428.

Dawson, A. B., 2010. Collective bargaining agreements in corporate reorganizations. American Bankruptcy Law Journal 84, 101–120.

Dawson, A. B., 2015. Labor activism in bankruptcy. American Bankruptcy Law Journal 89, 97–131.

Denis, D. J., Mihov, V. T., 2003. The choice among bank debt, non-bank private debt, and public debt: evidence from new corporate borrowings. Journal of Financial Economics 70, 3–28.

Diamond, D. W., 1991. Monitoring and reputation: The choice between bank loans and directly placed debt. The Journal of Political Economy 99, 689–721.

Diamond, D. W., 2004. Presidential address, committing to commit: Short-term debt when enforcement is costly. The Journal of Finance 59, 1447–1479.

DiNardo, J., Lee, D. S., 2004. Economic impacts of unionization on private sector employers: 1984-2001. The Quarterly Journal of Economics 119, 1383–1441.

Eisfeldt, A. L., Papanikolaou, D., 2013. Organization capital and the cross-section of expected returns. The Journal of Finance 68, 1365–1406.

Eisfeldt, A. L., Papanikolaou, D., 2014. The value and ownership of intangible capital. American Economic Review, Papers and Proceedings 104, 189–194.

Ellwood, D. T., Glenn, F., 1987. The impact of right-to-work laws on union organizing. Journal of Political Economics 95, 250–273.

Flammer, C., Ioannou, I., 2016. The dog that didn't bark: Long-term strategies in times of recession. Working Paper .

Flammer, C., Kacperczyk, A., 2016. The risk of knowledge spillovers and corporate social responsibility: Evidence from the inevitable disclosure doctrine. Working Paper .

Frandsen, B. R., 2015. The surprising impacts of unionization on establishments: Accounting for selection in close union representation elections. Working Paper .

Frandsen, B. R., 2016. Party bias in union representation elections: Testing for manipulation in the regression discontinuity design when the running variable is discrete. Advances in Econometrics 38.

Froot, K. A., Scharfstein, D. S., Stein, J. C., 1993. Risk management: Coordinating corporate investment and financing policies. The Journal of Finance 48, 1629–1658.

Gao, H., Luo, J., Tang, T., 2015. Effects of managerial labor market on executive compensation: Evidence from job-hopping. Journal of Accounting and Economics 59, 203–220.

Garmaise, M. J., 2011. Ties that truly bind: Noncompetition agreements, executive compensation, and firm investment. Journal of Law, Economics, and Organization 27, 376–425.

Gelman, A., Imbens, G., 2014. Why high-order polynomials should not be used in regression discontinuity designs. Working Paper .

Gilson, S. C., John, K., Lang, L. H., 1990. Troubled debt restructurings : An empirical study of private reorganization of firms in default. Journal of Financial Economics 27, 315–353.

Goetz, C. F., 2013. Falling house prices and labor mobility: Evidence from matched employer-employee data. CES-WP-13-43 .

Gomes, A., Phillips, G., 2012. Why do public firms issue private and public securities? Journal of Financial Intermediation 21, 619–658.

Graham, J. R., Smith, C. W., 1999. Tax incentives to hedge. The Journal of FInance 54, 2241–2262.

Hanley, K., Hoberg, G., 2017. Dynamic interpretation of emerging systemic risks. Working Paper .

Hoberg, G., Moon, S. K., 2016. Offshore activities and financial vs operational hedging. Journal of Financial Economics forthcoming.

Hoberg, G., Phillips, G., 2010. Product market synergies and competition in mergers and acquisitions: A text-based analysis. Review of Financial Studies 23, 3773–3811.

Houston, J., James, C., 1996. Bank information monopolies and the mix of private and public debt claims. The Journal of Finance 51, 1863–1889.

Imbens, G., Kalyanaraman, K., 2012. Optimal bandwidth choice for the regression discontinuity estimator. The Review of Economic Studies 79, 933–959.

Israelsen, Ryan D.and Yonker, S. E., 2016. Key human capital. Journal of Financial and Quantitative Analysis forthcoming.

Jochem, T., Ladika, T., Sautner, Z., 2016. The retention effects of unvested equity: Evidence from accelerated option vesting. Working Paper .

Kahnke, R. E., Bundy, K. L., Liebman, K. A., 2008. Doctrine of inevitable disclosure. Working Paper .

Klasa, S., Maxwell, W. F., Ortiz-Molina, H., 2009. The strategic use of corporate cash holdings in collective bargaining with labor unions. Journal of Financial Economicsl 92, 421–442.

Klasa, S., Ortiz-Molina, H., Serfling, M., Srinivasan, S., 2016. Protection of trade secrets and capital structure decisions. Working Paper .

Kovernock, D., Phillips, G., 1995. Capital structure and product-market rivalry: How do we reconcile theory and evidence? The American Economic Review 85, 403–408.

Kravet, T., Muslu, V., 2013. Textual risk disclosures and investors' risk perceptions. Review of Accounting Studies 18, 1088–1122.

Lee, D. S., 2008. Randomized experiments from non-random selection in us house elections. Journal of Econometrics 142, 675–697.

Lee, D. S., Lemieux, T., 2010. Regression discontinuity designs in economics. Journal of Economic Literature 48, 281–355.

Lee, D. S., Mas, A., 2012. Long-run impacts of unions on firms: New evidence from financial markets, 1961-1999. Quarterly Journal of Economics 127, 333–378.

Lin, C., Ma, Y., Malatesta, P., Xuan, Y., 2013. Corporate ownership structure and the choice between bank debt and public debt. Journal of Financial Economics 109, 517–534.

Lin, L., 2016. Collateral and the choice between bank debt and public debt. Management Science 62, 111–127.

Lustig, H., Syverson, C., Van Nieuwerburgh, S., 2011. Technological change and the growing inequality in managerial compensation. Journal of Financial Economics 99, 601–627.

Mackay, P., Phillips, G., 2005. How does industry affect firm financial structure? Review of Financial Studies 18, 1433–1466.

Matsa, D. A., 2010. Capital structure as a strategic variable: Evidence from collective bargaining. The Journal of Finance 65, 1197–1232.

McCrary, J., 2008. Manipulation of the running variable in the regression discontinuity design: A density test. Journal of Econometrics 142, 698–714.

Murfin, J., 2012. The supply-side determinants of loan contract strictness. The Journal of Finance 67, 1565–1601.

Nance, D. R., Smith, C. W., Smithson, C. W., 1993. On the determinants of corporate hedging. The Journal of Finance 48, 267–284.

Ochoa, M., 2013. Volatility, labor heterogeneity and asset prices. Working Paper .

Oi, W. Y., 1962. Labor as a quasi-fixed factor. The Journal of Political Economy 70, 538–555.

Oyer, P., 2004. Why do firms use incentives that have no incentive effects? The Journal of Finance 59, 1619–1650.

Park, C., 2000. Monitoring and structure of debt contracts. The Journal of Finance 55, 2157–2195.

Perotti, E. C., Spier, K. E., 1993. Capital structure as a bargaining tool: The role of leverage in contract renegotiation. The American Economic Review 83, 1131–1141.

Purnanandam, A., 2008. Financial distress and corporate risk management: Theory and evidence. Journal of Financial Economics 87, 706–739.

Rajan, R. G., 1992. Insiders and outsiders: The choice between informed and arm's-length debt. The Journal of Finance 46, 1367–1400.

Rampini, A. A., Sufi, A., Viswanathan, S., 2014. Dynamic risk management. Journal of Financial Economics 111, 271–296.

Rauh, J. D., 2006. Own company stock in defined contribution pension plans: a takeover defense? Journal of Financial Economicsl 81, 379–410.

Rauh, J. D., Sufi, A., 2010. Capital structure and debt structure. The Review of Financial Studies 23, 4242–4280.

Roberts, M. R., 2014. The role of dynamic renegotiation and asymmetric information in financial contracting. Journal of Financial Economicsl 116, 61–81.

Roberts, M. R., Sufi, A., 2009. Renegotiation of financial contracts: Evidence from private credit agreements. Journal of Financial Economics 93, 159–184.

Saiz, A., 2010. The geographic determinants of housing supply. The Quarterly Journal of Economics 125, 1253–1296.

Schmalz, M. C., 2015. Unionization, cash, and leverage. Working Paper .

Serfling, M., 2016. Firing costs and capital structure decisions. The Journal of Finance 71, 2239–2286.

Simintzi, E., Vig, V., Volpin, P., 2015. Labor protection and leverage. Review of Financial Studies 28, 561–591.

Struyven, D., 2014. Housing lock: Dutch evidence on the impact of negative home equity on household mobility. Working Paper .

Sufi, A., 2007. Information asymmetry and financing arrangements: Evidence from syndicated loans. The Journal of Finance 62, 629–668.

Towner, M., 2015. Leverage and bargaining benefits: Evidence from u.s. hospitals. Working Paper .

Wiesner, R. M., 2012. A state-by-state analysis of inevitable disclosure: A need for uniformity and a workable standard. Marquette Intellectual Property Law Review 16, 212–231.

Zhong, H., 2014. A dynamic model of optimal creditor dispersion. Working Paper .

Zingales, L., 2000. In search of new foundations. The Journal of Finance 55, 1623–1653.

Appendix A

Chapter 1 Appendices

Table 1.A1: Creditor Dispersion and Duration of Debt Contract Renegotiations

This table presents the relation between the number of creditors in a loan facility and the duration of debt contract renegotiations. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

# of Creditors	0.008***
	[0.003]
Log(Assets)	0.079
	[0.057]
Leverage	-0.601**
	[0.288]
ROA	0.406
	[1.223]
Tangibility	-0.034
	[0.273]
Capex	-0.976
	[0.678]
Market to Book	0.011
	[0.073]
Stock Return Volatility	-6.005
	[4.859]
Log(Maturity)	0.140
	[0.101]
Log(Amount)	-0.060
	[0.061]
Loan Type & Purpose FEs	Y
Adj. R^2	0.091
N	387

Table 1.A2: Tests of Discontinuities in the First Difference in Predetermined Characteristics between T-1 and T-2

This table presents the results of tests for the null hypothesis that there is no systematic difference in the first difference in predetermined firm characteristics from T-2 to T-1 between firms in treatment and control groups. We implement an RD estimation with a rectangular kernel and the optimal bandwidth for each predetermined firm characteristic including debt structure measures, firm size, book leverage, market leverage, market-to-book ratio, tangibility, ROA, modified Z-score, and cash holding. All RD estimations include vote shares allowing for different intercepts and slopes on each side of the cutoff. Standard errors are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

Variables:	Coeff.	Z-stat Value
Outcome Variables		
Public/AT	-0.008	-0.566
Public/MV	-0.003	-0.201
Public/Total Debt	-0.023	-0.606
Bank/AT	0.009	0.665
Bank/MV	0.005	0.301
Bank/Total Debt	0.035	0.944
Firm Characteristics		
Log(AT)	0.013	0.574
BookLev	-0.015*	-1.749
MarkLev	-0.015	-1.280
MTB	0.055*	1.752
Tangibility	-0.000	-0.034
ROA	0.002	0.751
Modified Z-score	0.072	1.414
Cash Holding	-0.001	-0.110

Table 1.A3: Do Firms Adjust Debt Structure as a Response to Union Certification? Polynomial Regressions

This table presents the adjustment of debt structure to unionization certification. We use six measures throughout the analysis: public or bank debt scaled by total asset, public or bank debt scaled by market value, and public or bank debt scaled by total debt. All results are estimated using local linear regressions with a rectangular kernel. Panels A, B, C, and D present estimation results using polynomial order equal to three, four, five, and six, respectively. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

Panel A: Polynomial Order = 3						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	0.053***	0.068**	0.154***	-0.050**	-0.052**	-0.149***
	[0.019]	[0.027]	[0.053]	[0.020]	[0.021]	[0.052]
N	851	851	851	851	851	851
Panel B: Polynomial Order = 4						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	0.067***	0.100***	0.222***	-0.058**	-0.067**	-0.192***
	[0.025]	[0.033]	[0.064]	[0.024]	[0.026]	[0.063]
N	851	851	851	851	851	851
Panel C: Polynomial Order = 5						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	0.087***	0.126***	0.283***	-0.092***	-0.103***	-0.240***
	[0.029]	[0.039]	[0.077]	[0.028]	[0.032]	[0.072]
N	851	851	851	851	851	851
Panel D: Polynomial Order = 6						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	0.095***	0.134***	0.297***	-0.098***	-0.104***	-0.271***
	[0.033]	[0.045]	[0.090]	[0.033]	[0.037]	[0.082]
N	851	851	851	851	851	851

Table 1.A4: Do Firms Adjust Debt Structure as a Response to Union Certification? Tally-Based Running Variable

This table presents the adjustment of debt structure to unionization certification. We use six measures throughout the analysis: public or bank debt scaled by total asset, public or bank debt scaled by market value, and public or bank debt scaled by total debt. All results are estimated using local linear regressions with a rectangular kernel. Panels A and B present estimation results using bandwidths equal to 5 and 10 vote counts, respectively. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

Panel A: Bandwidth=5 Vote Counts						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	0.101***	0.143***	0.301***	-0.083**	-0.099**	-0.266***
	[0.037]	[0.051]	[0.097]	[0.036]	[0.040]	[0.094]
N	83	83	83	83	83	83
Panel B: Bandwidth=10 Vote Counts						
	Public Debt			Bank Debt		
Scaled by:	Total Asset	Market Value	Total Debt	Total Asset	Market Value	Total Debt
WIN	0.057**	0.084**	0.191***	-0.083***	-0.093***	-0.203***
	[0.026]	[0.035]	[0.066]	[0.026]	[0.029]	[0.064]
N	173	173	173	173	173	173

Data source and variable definitions

The labor union election data are from the Thomas J. Holmes website and the NLRB website. The debt structure data come from a hand-collected data set from the section "Notes to Financial Statement" in 10-Ks. The bond and bank loan new issuance data are from SDC Platinum and LPC DealScan database, respectively. The accounting data are from Compustat. Debt structure and Compustat variables are winsorized at a 5% level on each tail. Item names refer to Compustat annual data items.

Variable	Definition
Labor Union Election Data	
WIN	A dummy variable equal to one if a majority of employees vote for unions in an election and zero otherwise. Source: Thomas J. Holmes website and NLRB website.
Vote Share	The portion of votes for unions over total valid votes in an election. Source: Thomas J. Holmes website and NLRB website.
Airline Data	
Wages/Employees	Total salaries in a year divided by annual total employment. Source: Schedules P-6 and P-10 in Form 41 database.
Firm Size	Natural logarithm of total assets (2010 dollars). Source: Schedule B-1 in Form 41 database.
Earnings	Income before discontinued operations and extraordinary items and depreciation and amortization. Source: Schedule P-12 in Form 41 database.
Profitability	Earnings divided by total assets. Source: Schedules B-1 and P-12 in Form 41 database.
Tangibility	Property And Equipment - Net divided by total assets. Schedule B-1 in Form 41 database.
Neg. Earning	A dummy variable equal to one if a firm's earnings are less than or equal to zero in a year and zero otherwise. Source: Schedule P-12 in Form 41 database.
Debt Structure Data	
Public/AT	Outstanding amount of public debt scaled by total assets. Source: A hand-collected data set and Compustat.
Public/MV	Outstanding amount of public debt scaled by market value. Source: A hand-collected data set and Compustat.
Public/Debt	Outstanding amount of public debt scaled by total debt. Source: A hand-collected data set and Compustat.
Bank/AT	Outstanding amount of bank debt scaled by total assets. Source: A hand-collected data set and Compustat.
Bank/MV	Outstanding amount of bank debt scaled by market value. Source: A hand-collected data set and Compustat.
Bank/Debt	Outstanding amount of bank debt scaled by total debt. Source: A hand-collected data set and Compustat.
Firm Characteristics	
Firm Size	Natural logarithm of deflated Item AT (2010 dollars). Source: Compustat.
Total Debt	Item DLTT+ Item DLC. Source: Compustat.
Book Leverage	(Item DLTT+ Item DLC)/Item AT. Source: Compustat.
Market Leverage	(Item DLTT + Item DLC)/(Item PRCC_F×Item CSHO+Item DLTT + Item DLC). Source: Compustat.
Market-to-Book	(Item PRCC_F×Item CSHO+Item DLTT + Item DLC+Item PSTKL-Item TXDITC) / Item AT. Source: Compustat.
Tangibility	Item PPENT/Item AT. Source: Compustat.
ROA	Item OIBDP/Item AT. Source: Compustat.
TFP	Firm-level total factor productivity. Source: Selale Tuzel's webpage avaialble at `http://www-bcf.usc.edu/~tuzel/`

Variable	Definition
R&D	Item XRD/Item SALE. Missing values in Item XRD are replaced with zero. Source: Compustat.
Capex	Item CAPX/Item AT. Source: Compustat.
Z-score	3.3×(Item IB+Item TXT+Item XINT)/Item AT+1.4×Item RE/Item AT+Item SALE/Item AT+1.2×(Item ACT-Item LCT)/Item AT+0.6×PRCC_F×CSHO/LT. Source: Compustat.
Modified Z-score	3.3×(Item IB+Item TXT+Item XINT)/Item AT+1.4×Item RE/Item AT+Item SALE/Item AT+1.2×(Item ACT-Item LCT)/Item AT. Source: Compustat.
Dividend Payer	A dummy variable equal to one if cash dividend is positive and zero otherwise. Source: Compustat.
Credit Rating	Each S&P long-term debt rating is assigned to a numerical number. 1 for "AAA", 2 for "AA+", 3 for "AA", ...Source: Compustat.
Downgrade	A dummy variable equal to one if the average credit rating in the following three years after a labor union election is lower than the rating one year before the election.Source: NLRB and Compustat.
Bid-Ask Spread	The median monthly bid-ask spread deflated by the stock price at the end of a fiscal year. When bid-ask spread is missing, the value is replaced by the difference between closing ask and closing bid. Source: CRSP.
Other Data	
Underfunding status of DB Pension Plan	A dummy variable equal to one if Item PPLAO is less than or equal to Item PBPRO and zero otherwise. Source: Compustat Pension Annual.
SyndSize1	Number of creditors defined at loan tranche level. Source: DealScan.
SyndSize2	Number of creditors defined at loan deal level. Source: DealScan.
HHI	HHI for creditor ownership concentration. Source: DealScan.
Spread of Bank Loan	All-in-drawn spread. Source: DealScan.
Spread of Public Bond	The difference between public bond yield and maturity-matched Treasury bond yield. Source: Mergent FISD and FRED at Federal Reserve Bank of St. Louis.
DC Pension Ownership	Fraction of a firm's equity value held by employees through DC pension assets. EOYSTOCK/(Item PRCC_F*Item CSHO*10^6). Source: IRS 5500 Form and Compustat.
Fraction of DC Pension Assets Invested in a Firm's Stock	EOYSTOCK/EOYASSET. Source: IRS 5500 Form.

Data Assembly

In order to merge labor union election data with firm-level data, we match employers' names in the NLRB data with historical stock names (DSENAME file in CRSP) and Compustat firm names.[1] We refer to the file containing historical stock names and Compustat firm names as the standard firm name file. Three steps are involved in the name-matching process:

1. We follow Lee and Mas (2012) and use a SAS algorithm to perform a fuzzy name matching between the employers' names in the NLRB labor union election data and the standard firm name file.

2. We manually check each match to verify whether it is correct after the fuzzy matching. When one firm in the NLRB data cannot be matched with any name in the standard firm name file, we use the LexisNexis Corporate Affiliation Database and Bloomberg Businessweek to check whether this firm is a subsidiary of another firm in the standard firm name file. This step generates the NLRB-CRSP-COMPUSTAT merged data. We obtain GVKEY and CIK as identifiers for each matched election.

3. We use information on CIK to hand-collect the firm's debt structure information from a firm's 10-Ks' "Notes to Financial Statements" section in the EDGAR database for each election in NLRB-CRSP-COMPUSTAT. The debt structure information is collected from one fiscal year before an election to three fiscal years after the election.

In the database, we observe multiple elections within some plants. For purely duplicative records, we simply drop the duplicative observations. For the cases in which there are multiple elections simultaneously held in the same establishment because of multiple bargaining units or unions, we retain the election with the largest vote share, as in Frandsen (2015). Because labor union elections are conducted at the plant level, it is possible to have multiple elections in one year within the same firm. For each firm-year observation, we keep the election with the largest number of eligible voters, since such elections are possibly most important for corporate decisions. Moreover, for each election we also require that debt structure information is available one year before and at least one year after the election in the following three years. Finally, the final main sample used in this paper spans from 1992 to 2009 and includes 851 elections involving 427 unique firms.

Furthermore, following similar procedures, we also manually match labor union election data with DealScan by firm names in order to examine the effects of union certification on loan issuance behavior.

Institutional Background of Labor Union Elections

The following steps describe the NLRB labor union election process. The steps are largely adapted from the description on the NLRB website.[2]

[1] We also match Compustat firm names to increase the sample size, since some firms covered in Compustat are not covered in CRSP. If a firm in Compustat changed its name after the union election, then the name of the firm where the election was held is possibly not matched to a Compustat firm name.

[2] National Labor Relations Board, `http://www.nlrb.gov/what-we-do/conduct-elections`.

1. A group of employees file a petition with the nearest NLRB Regional Office. The portion of employees who show interest in labor unions must be at least 30%. The agents will investigate whether the Board has jurisdiction, the union is qualified, and there is any wage contract in place.

2. Agents will seek an agreement between the employer and union about the conditions of elections. If an agreement is reached, then the parties will authorize the regional director to conduct an election. If no agreement is reached, the regional director will set election conditions and order an election.

3. An election is typically held within 30 days of a director's authorization or order. The outcomes of representation and decertification elections are determined by a majority of votes cast. Objections may be filed with the appropriate regional director by any party within seven days of the vote count. The outcome of an election will be set aside if conduct by either the employer or union interfered with employees' freedom of choice.

4. When a union is in place, another union could file an election petition as long as the labor contract has expired or is about to expire and 30% of employees show interest in the competing union. This typically leads to a three-way election, with the choices being the incumbent, the challenging one, and none.

5. If no objection is raised by either party, the union that receives the majority of the votes cast is certificated as the bargaining representative. The employer recognizes this union as the exclusive bargaining agent for employees in that unit.

Employees can use a second approach to choose a representative. They can persuade the employer to voluntarily recognize a union if they can show that majority support for the union is present among employees. These agreements are made out of the NLRB process. DiNardo and Lee (2004) also show that there is no single path to union representation.

Appendix B

Chapter 2 Appendices

Appendix 2.A: Variable Definitions

Variable	Definition
Skilled Labor Risk and Labor Market	
Skilled Labor Risk	Number of sentences a firm spend discussing risk associated with skilled labor in the 10-K in a year. Source: Corporate 10-K filings in EDGAR Database.
# of SIC2 Rivals (50 mi radius)	Number of publicly traded firms in the same 2-digit SIC industry within a 50-mile radius around a firm's headquarters. Source: Corporate 10-K filings in EDGAR Database and Compustat.
# of SIC2 Rivals (50-100 mi radius)	Number of publicly traded firms in the same 2-digit SIC industry located outside a 50-mile radius but within a 100-mile radius around a firm's headquarters. Source: Corporate 10-K filings in EDGAR Database and Compustat.
# of SIC2 Rivals (100-200 mi radius)	Number of publicly traded firms in the same 2-digit SIC industry located outside a 100-mile radius but within a 200-mile radius around a firm's headquarters. Source: Corporate 10-K filings in EDGAR Database and Compustat.
# of SIC2 Rivals (Outside 200 mi radius)	Number of publicly traded firms in the same 2-digit SIC industry outside a 200-mile radius around a firm's headquarters. Source: Corporate 10-K filings in EDGAR Database and Compustat.
# of Non-SIC2-Rivals (50 mi radius)	Number of publicly traded firms that are not in the same 2-digit SIC industry and within a 50-mile radius around a firm's headquarters. Source: Corporate 10-K filings in EDGAR Database and Compustat.
# of Non-SIC2-Rivals (50-100 mi radius)	Number of publicly traded firms that are not in the same 2-digit SIC industry and located outside a 50-mile radius but within a 100-mile radius around a firm's headquarters. Source: Corporate 10-K filings in EDGAR Database and Compustat.
# of Non-SIC2-Rivals (100-200 mi radius)	Number of publicly traded firms that are not in the same 2-digit SIC industry and located outside a 100-mile radius but within a 200-mile radius around a firm's headquarters. Source: Corporate 10-K filings in EDGAR Database and Compustat.
# of Non-SIC2-Rivals (Outside 200 mi radius)	Number of firms that are not in the same 2-digit SIC industry and outside a 200-mile radius around a firm's headquarters. Source: Corporate 10-K filings in EDGAR Database and Compustat.
Distance to Land-Grant U. (100 Miles)	A firm's average distance to all land-grant universities and colleges in U.S. Source: Corporate 10-K filings in EDGAR Database and United States Department of Agriculture.

Variable	Definition
Distance to In-State Land-Grant U. (100 Miles)	A firm's average distance to all land-grant universities and colleges in the firm's headquarters state. Source: Corporate 10-K filings in EDGAR Database and United States Department of Agriculture.
Compensation and Executive Characteristics	
CEO Compensation ($000)	Total compensation for the CEO. For the data under the old disclosure rule, it equals to TDC1 in Execucomp; for the data under the new disclosure rule, it equals the sum of salary, bonus, deferred compensation earnings reported as compensation, other compensation (from Execucomp), and the present value of stock options (Black-Scholes value), restricted stocks and incentive plan awards at the grant data (From Equilar). Source: Execucomp and Equilar.
Avg. Executive Compensation($000)	Average total compensation for all executives with reported compensation data. The total compensation is defined in the same way as for CEO. Source: Execucomp and Equilar.
CEO Cash Pay/Total Pay	Fraction of cash pay in total compensation for the CEO. Cash pay equals the sum of salary and bonus. Source: Execucomp.
Avg. Executive Cash Pay/Total Pay	Average fraction of cash pay in total compensation for the executive team. Cash pay equals the sum of salary and bonus. Source: Execucomp.
CEO Incentive Pay/Total Pay	Fraction of incentive pay in total compensation for the CEO. Incentive pay equals the sum of grant date present value of stock options, restricted stocks, and incentive plan awards. Source: Execucomp and Equilar.
Avg. Executive Incentive Pay/Total Pay	Average fraction of incentive pay in total compensation for the executive team. Incentive pay equals the sum of grant date present value of stock options, restricted stocks, and incentive plan awards. Source: Execucomp and Equilar.
CEO Pay Duration	Average pay duration of the CEO. The definition follows Gopalan et al. (2014). Source: Execucomp and Equilar.
Avg. Executive Pay Duration	Average pay duration of the executive team. The definition follows Gopalan et al. (2014). Source: Execucomp and Equilar.
CEO Age	Age of the CEO. Source: Execucomp
CEO Tenure	Tenure (in years) of the CEO. Source: Execucomp
Execu.Turnover in Past 3 Yr	A dummy variable equal to one if a firm experiences at least one executive departure in the past three years (including current year) and zero otherwise. Source: Execucomp and authors' calculation
Execu.Turnover in Next 3 Yr	A dummy variable equal to one if a firm experiences at least one executive departure in the next three years and zero otherwise. Source: Execucomp and authors' calculation
Non-chief-executive Employee Compensation ($000)	Total compensation for the non-chief-executive employees. Source: Compustat and Quarterly Census of Employment and Wages (QCEW)
Non-chief-executive Employee Incentive Pay/Total Pay	The fraction of the Black-Scholes value of broad-based stock options granted to the non-executive employees in total compensation for the non-chief-executive employees. Source: Execucomp and Compustat
Log(Skilled Labor Salary)	Natural logarithm of the salary of skilled labor. Source: The Foreign Labor Certification Data Center available at `http://www.flcdatacenter.com/`
Total Strengths of Employee Relations	The average rating across all dimensions in employee relations. Source: MSCI database
Compensation&Benefits-Related Strengths of Employee Relations	The average rating in employee relations related to compensation and benefits. There are four dimensions related to compensation&benefits including Cash Profit Sharing Strength, Employee Involvement Strength, Retirement Benefits Strength, and Compensation & Benefits Strength. Source: MSCI database
Other Strengths of Employee Relations	The average rating in employee relations that are not related to compensation and benefits. Source: MSCI database

Variable	Definition
Firm-year level Characteristics and Financial Policies	
Cash Holding	(Cash + short-term investment)/total assets: (CHE/AT). Source: Compustat.
Book Leverage	Total debt/(Total debt+ equity): (DLC+DLTT)/(DLC+DLTT+CEQ). If CEQ<0, we set it as missing. If the calculated leverage is larger than one, we set it as one. Source: Compustat.
Market Leverage	Total debt/(Total debt+ market value of equity). If the calculated leverage is larger than one, we set it as one. Source: Compustat.
Log(Assets)	Natural logarithm of total assets: Log(AT). Source: Compustat.
Firm Age	Firm age is calculated as the difference between the current year and the firm's starting year. The starting year is defined in the following order: (1) the founding year; (2) the IPO year if the founding year is missing; (3) the year of first trading with non-missing price from CRSP if the IPO year is missing; (4) the first year in Compustat if there is no trading information in CRSP. Source: Jay Ritter's IPO Database, CRSP, and Compustat.
Market to Book	(Equity value+total assets-book equity)/total book assets: (PRCCF_F×CSHO+AT-CEQ)/AT. If CEQ<0, we set it as missing. Source: Compustat.
Tangibility	(Property, Plant and Equipment)/total assets: PPENT/AT. Source: Compustat.
Intangible Assets	(Intangible assets on the balance sheet)/total assets: INTAN/AT. Source: Compustat.
Capex	Capital expenditures/total assets: CAPX/AT. Source: Compustat.
R&D	(Research and development expenses)/total assets: XRD/AT. If XRD is missing, we set it as zero. Source: Compustat.
Sales Growth	(Sales(t)/CPI(t)-Sales(t-1)/CPI(t-1))/(Sales(t-1)/CPI(t-1). Source: Compustat and FRED Database.
ROA	(Operating Income Before Depreciation)/total assets: OIBDP/AT. Source: Compustat.
Sales Vol.	The standard deviation of 5-year (including the current year) sales to total assets ratio. Source: Compustat.
Organizational Capital	The measure for the stock of organizational capital in Eisfeldt and Papanikolaou (2013) divided by total assets. Source: Compustat
Modified Organizational Capital	The measure for the stock of organizational capital in Peters and Taylor (2017) divided by total assets. Source: Luke Taylor's webpage at `http://finance-faculty.wharton.upenn.edu/luket/publications/`
Mention Key Man Insurance	A dummy variable equal to one if a firm mentions "Key Man Life Insurance" in at least on electronic corporate filing in a year and zero otherwise. Source: Israelsen and Yonker (2015)
Carry Key Man Insurance	A dummy variable equal to one if a firm carries "Key Man Life Insurance" in a year and zero otherwise. Source: Israelsen and Yonker (2015)
Industry-level Skilled Labor Reliance	Fraction of high skilled labor in an industry. Source: Belo et al. (2016)
Total Volatility	Standard deviation of daily stock return in a fiscal year. Source: CRSP Daily Stock Return File
Idiosyncratic volatility	Standard deviation of the residual from a regression of daily stock returns on the three Fama-French factors in a fiscal year. Source: CRSP Daily Stock Return File
Beta	Estimated coefficient on the market factor from a regression of daily stock returns on the three Fama-French factors in a fiscal year. Source: CRSP Daily Stock Return File

Variable	Definition
G-Index	G-index. Source: ISS (Risk Metrics)
Fraction of Independent Directors	Fraction of Independent Directors in a firm. Source: ISS (Risk Metrics)
CEO & Chairman	A dummy variable indicating whether CEO is also the board chairman in a firm-year. Source: ISS (Risk Metrics)
State-year level Variables	
Non-Compete	Non-compete covenants enforcement index. Data since 2005 is imputed using the value in 2004. Source: Germaise (2011).
Real Estate Transfer Tax (%)	Transfer tax rate on residential housing transactions in a state. Source: Thomson Reuters CheckPoint Database and Lincoln Institute of Land Policy.
Employment Rate	The ratio of number of jobs to total population in a state. Source: The Bureau of Economic Analysis.
Log(Income Per Cap.)	Natural logarithm of real income per capital in a state. Source: The Bureau of Economic Analysis.
Log(Population)	Natural logarithm of total population in a state. Source: The Bureau of Economic Analysis.
State Colleges Per Cap $\times 10^6$	Number of higher education institutions per one million population in a state. Source: The National Center for Education Statistics

Appendix 2.B: The Effects of the Inevitable Disclosure Doctrine (IDD)

Based on the court rulings on the IDD identified by Klasa et al. (2016), ten states had a change in their IDD recognition during our sample period.[1] These changes allow us to identify the IDD effect on firms' skilled labor risk. We assume that a firm-year is affected by the state court decision regarding the adoption or rejection of the IDD if the firm's annual 10-K filing date is at least three months after the decision date. Since the 10-K filing preparation time is on average about 3 months, the 3-month lag gives firms time to react to the court decision. For each firm, we create an indicator variable "IDD" that equals zero for years before the IDD adoption decision in its headquarters state or after the decision that reversed the state court's previous favorable position on IDD, and equals one after the adoption decision or before the rejection of the previous adoption.

Our empirical approach is a difference-in-differences method.[2] The results are reported below. The estimations show that the effect of IDD on Skilled Labor Risk is negative and significant, which suggests that the adoption (rejection) of the IDD in a state decreases (increases) firms' skilled labor risk. The results in column (3) further suggests that the adoption of the IDD makes firms' skilled labor risk insensitive to local labor market competition. In column (4), we report the dynamic treatment effects and examine whether the parallel trends assumption is satisfied. IDD-t is a dummy variable that indicates t years from the year of the IDD adoption date (plus 3 months). IDD Rejection is a dummy variable that equals to one if a firm's annual report filing date is at least three months after the rejection of the previously adopted IDD in the headquarters state and zero otherwise. The estimations show that the coefficients on IDD^{-3}, IDD^{-2}, IDD^{-1}, and IDD^{0} are insignificant and the skilled labor risk of affected firms decreases relative to unaffected firms only after the adoption of the IDD. Overall, the results suggests that the parallel trends assumption is not violated in our sample.

[1] They are Arkansas (adopted IDD in March 1997), Florida (rejected the previously adopted IDD in May 2001), Georgia (adopted IDD in June 1998), Kansas (adopted IDD in February 2006), Michigan (rejected the previously adopted IDD in April 2002), Missouri (adopted IDD in November 2000), Ohio (adopted IDD in September 2000), Texas (rejected the previously adopted IDD in April 2003), Utah (adopted IDD in January 1998), and Washington (adopted IDD in December 1997)

[2] Note that the specification with the IDD indicator and firm fixed effects and year fixed effects on the right-hand-side essentially produces the difference-in-differences estimator

The Effects of the Inevitable Disclosure Doctrine

This table reports the effect of the recognition of the Inevitable Disclosure Doctrine (IDD) in a firm's headquarters state on the firm's skilled labor risk. IDD is a dummy variable that equals to one if a firm's annual report filing date is at least three months after the adoption of the IDD and before the rejection of the previous adoption of the IDD if applicable in the headquarters state and equal to zero otherwise. IDD^{-3}, IDD^{-2}, IDD^{-1}, IDD^{0}, IDD^{+1}, IDD^{+2}, and IDD^{3+} are dummy variables that equal to one if the differences between a firm's annual report filing year and the year of IDD adoption date plus 3 months are minus three, minus two, minus one, zero, one, two, and at least three, respectively, and zero otherwise. IDD rejection is a dummy variable that equals to one if a firm's annual report filing date is at least three months after the rejection of the previously adopted the IDD in the headquarters state and zero otherwise. # of SIC2 Rivals (50 mi radius) is standardized by its standard deviation. Standard errors in parentheses are robust and clustered at the state level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
IDD	-0.109**	-0.150*	-0.005	
	[0.049]	[0.085]	[0.105]	
IDD*# of SIC2 Rivals (50 mi radius)			-0.366***	
			[0.076]	
# of SIC2 Rivals (50 mi radius)			0.311***	
			[0.036]	
IDD^{-3}				0.084
				[0.100]
IDD^{-2}				0.043
				[0.124]
IDD^{-1}				-0.069
				[0.153]
IDD^{0}				-0.204
				[0.166]
IDD^{+1}				-0.047
				[0.190]
IDD^{+2}				-0.254*
				[0.150]
IDD^{3+}				-0.238*
				[0.131]
IDD Rejection				0.115
				[0.090]
Log(Assets)		0.377***	0.359***	0.378***
		[0.027]	[0.029]	[0.027]
Log(1+FirmAge)		-0.115	-0.074	-0.119
		[0.190]	[0.171]	[0.191]
ROA		-0.296**	-0.274**	-0.296**
		[0.117]	[0.108]	[0.116]
Market to Book		0.041***	0.038***	0.041***
		[0.009]	[0.009]	[0.009]
Sales Growth		0.077***	0.076***	0.077***
		[0.017]	[0.016]	[0.017]
R&D		0.033**	0.035**	0.033**
		[0.013]	[0.014]	[0.013]
R&D Missing		-0.026	-0.012	-0.028
		[0.133]	[0.131]	[0.133]
Capex		0.685***	0.710***	0.687***
		[0.221]	[0.219]	[0.221]
Tangibility		0.101	0.093	0.102
		[0.189]	[0.175]	[0.189]
Intangible Assets		0.426***	0.496***	0.425***
		[0.154]	[0.154]	[0.155]
Sales Vol.		0.035	0.017	0.036
		[0.100]	[0.097]	[0.100]
Employment Rate		-0.348	-0.747	-0.365
		[0.785]	[0.711]	[0.763]
Log(Income Per Cap.)		0.607	0.651	0.608
		[0.487]	[0.482]	[0.484]
Log(Population)		-0.028	-0.124**	-0.019
		[0.050]	[0.050]	[0.049]
Firm FE & Filing Yr FE	Y	Y	Y	Y
Adj. R^2	0.735	0.756	0.757	0.756
N	104716	70500	70500	70500

Appendix 2.C: Relation to Related Measures and Advantages

There are three existing measures that are related to firms' skilled labor risk. The first one is a measure of organizational capital based on firms' SG&A expenses (Eisfeldt and Papanikolaou (2013)). The authors define organizational capital as a production factor that is embodied in a firm's key talents, and measure the stock of Organizational Capital by cumulating firms' SG&A expenses using the perpetual inventory method. SG&A expenses are relevant to capturing the flow to organizational capital because a part of SG&A represents the labor related expenses (e.g., white collar wages, training). Two recent studies, however, recognize some shortcomings of the SG&A based measure due to the way Compustat reports the SG&A item (Falato et al. (2013) and Peters and Taylor (2017)). First, the SG&A reported in Compustat (item xsga) includes R&D expense (item xrd). Second, a large fraction of the reported SG&A in Compustat represents operating costs that are unrelated to the investments in organizational capital. For the expenses that are related to organizational capital investments, they reflect not only investments in employee training but also expenses in advertising, marketing and commissions. Peters and Taylor (2017) modify the organization capital measure by replacing SG&A with 0.3*(xsga-xrd).

The second measure is based on firm's disclosures on the "Key Man Life Insurance" in corporate filings, which insures the firm against losses from losing certain key talents due to deaths (Israelsen and Yonker (2015)). The authors create dummy variables to identify both firms that mention but do not necessarily carry such insurance in 10-K filings (Mention Key Man Insurance) and those that actually carry such insurance on key employees (Carry Key Man Insurance).

The last measure is the industry-level labor skill measure, Industry-level Skilled Labor Reliance, developed in Belo et al. (2016). The authors use the information on the skill level required for each occupation and calculate the fraction of high skilled labor in an industry as a proxy for the reliance on skilled labor in the industry.

Panels A and B of Appendix Table C present both the pairwise and the Spearman rank correlation matrices for our skilled labor risk measure and these related measures. For the correlations between any firm-level skilled labor risk measure and Industry-level Skilled Labor Reliance, we first calculate the average of the firm-level measure in each industry-year and then calculate the correlations at the industry-year level. The results show that our skilled labor risk measure is strongly and positively correlated with the industry-level measure of skilled labor reliance and firms' tendency to discuss key man life insurance in corporate filings. The correlation with the SG&A based organizational capital measures is, however, weaker.

A potential advantage of our skilled labor risk measure relative to these related measures is that it can better capture skilled labor risk due to the mobility of skilled labor. Intuitively, firms that intensively discuss the attraction and retention of skilled labor as a risk factor are likely those for which skilled labor are not only important but their participation constraints are also likely binding. The industry-level occupation-skill based measure focuses mainly on the reliance of labor skill. The key man life insurance is more about risk of losing key employees due to deaths than due to their mobility. The SG&A based measure seems to be an indirect measure of a firm's reliance on skilled labor and is unlikely to pick up the risk due to skilled labor mobility.

In Panel C of Appendix Table C, we compare the sensitivities of various measures related to

skilled labor risk to skilled labor mobility and supply. Each measure is scaled by its sample mean to facilitate comparison across measures. The results show that in general, the two Organizational Capital measures and the two measures based on firm disclosure of Key Man Life Insurance are either insignificantly correlated with skilled labor mobility and supply or significantly correlated with them in unexpected ways. Overall, the results in Appendix Table C suggest that compared with existing related measures, our measure better captures firm risk due to mobility of skilled labor and the lack of supply of educated labor.

Relation to Related Measures and Advantages

This table presents relations between our measure, Skilled Labor risk, and the existing related measures. Panels A and B report the pairwise and Spearman rank correlations between Skilled Labor Risk and existing related measures. Panel C compares the effects of the mobility and supply of skilled labor on our skilled labor risk measure and existing related measures. The dependent variable in each column of Panel C is standardized by its own sample mean. Organizational Capital is the measure for the stock of organizational capital in Eisfeldt and Papanikolaou (2013), which accumulates the deflated value of SG&A expenses, divided by total assets. Modified Organizational Capital is the measure for the stock of organizational capital in Peters and Taylor (2017), which accumulates the deflated value of 30% of the SG&A expenses after excluding R&D expenses, divided by total assets. Mention Key Man Insurance and Carry Key Man Insurance are measures for key human capital in Israelsen and Yonker (2015). Mention Key Man Insurance is a dummy variable that equals to one if a firm mentions key man life insurance in corporate filings a year and zero otherwise. Carry Key Man Insurance is a dummy variable that equals to one if a firm actually carries key man life insurance on key employees in a year and zero otherwise. Industry-level Skilled Labor Reliance is the fraction of high skilled labor in an industry in Belo et al. (2016). For the pairwise and rank correlations in the last row of each panel, we first calculate the average of the firm-level measures in each industry-year and then calculate the correlations at the industry-year level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively. In Panel C, standard errors in parentheses are robust and clustered at the firm level. Letters a, b, and c represent statistical difference at 1%, 5%, and 10% levels, respectively, for the differences between the coefficients in column (1) and those in each of the other columns.

Panel A: Pairwise Correlations

	Skilled Labor Risk	Organizational Capital	Modified Organizational Capital	Mention KeyMan Insurance	Carry KeyMan Insurance
Skilled Labor Risk	1.000				
Organizational Capital	-0.025***	1.000			
Modified Organizational Capital	-0.034***	0.972***	1.000		
Mention KeyMan Insurance	0.174***	0.052***	0.048***	1.000	
Carry KeyMan Insurance	0.071***	0.032***	0.037***	0.650***	1.000
Industry-level Skilled Labor Reliance	0.283***	0.036**	-0.001	0.045**	0.0200

Panel B: Rank Correlations

	Skilled Labor Risk	Organizational Capital	Modified Organizational Capital	Mention KeyMan Insurance	Carry KeyMan Insurance
Skilled Labor Risk	1.000				
Organizational Capital	0.066***	1.000			
Modified Organizational Capital	0.034***	0.984***	1.000		
Mention KeyMan Insurance	0.193***	0.054***	0.046***	1.000	
Carry KeyMan Insurance	0.089***	0.055***	0.056***	0.650***	1.000
Industry-level Skilled Labor Reliance	0.223***	-0.0700***	-0.104***	0.016	0.035*

	Panel C: Comparisons with Existing Related Measures				
	Skilled Labor Risk	Organizational Capital	Modified Organizational Capital	Mention KeyMan Insurance	Carry KeyMan Insurance
	(1)	(2)	(3)	(4)	(5)
# of SIC2 Rivals (50 mi radius)	0.077***	0.009[a]	-0.001[a]	0.028	-0.080[a]
	[0.014]	[0.010]	[0.009]	[0.035]	[0.056]
Non-Compete	-0.008	-0.001	0.001	-0.005	-0.008
	[0.005]	[0.004]	[0.003]	[0.017]	[0.029]
Real Estate Transfer Tax	-0.086***	-0.009[a]	0.001[a]	0.001[c]	0.219***[a]
	[0.017]	[0.013]	[0.012]	[0.048]	[0.084]
Distance to Land-Grant U.	0.039***	-0.004**[a]	-0.007***[a]	0.009[a]	-0.001[a]
	[0.004]	[0.002]	[0.002]	[0.010]	[0.015]
Firm&State Controls	Y	Y	Y	Y	Y
Ind. FE & Yr FE	Y	Y	Y	Y	Y
Adj. R^2	0.335	0.350	0.368	0.093	0.063
N	71334	71334	71334	34220	34220

Appendix 2.D: Firm Characteristics by High and Low State Real Estate Transfer Tax Rates

This table compares firm characteristics for firms headquartered in states with high and low real estate transfer tax rates. High (Low) Tax Rate dummy equals one if a state's real estate transfer tax rate in 1997 is no less than the sample median and zero otherwise. Total volatility, idiosyncratic volatility, book leverage, market leverage, and cash holding are expressed in percentage points. Robust standard errors for calculating the p-value of difference are clustered at the state level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	High Tax Rate	Low Tax Rate	Difference	p-value of Difference
Firm Size	6.854	6.606	0.223	0.278
Firm Age	38.585	33.587	5.028	0.117
ROA	0.129	0.122	0.007	0.516
Market to Book	1.926	2.019	-0.085	0.624
Sales Growth	0.094	0.127	-0.032	0.101
R&D	0.046	0.081	-0.035	0.399
Capex	0.045	0.058	-0.014	0.120
Tangibility	0.240	0.274	-0.035	0.498
Intangible Assets	0.183	0.152	0.032	0.001
Sales Vol.	0.144	0.162	-0.017	0.122
Total Volatility (%)	3.032	3.297	-0.261	0.226
Idiosyncratic Volatility (%)	2.799	3.054	-0.250	0.216
Beta	1.052	1.109	-0.057	0.198
Book Leverage (%)	33.693	29.516	4.132	0.235
Market Leverage (%)	22.588	19.840	2.652	0.342
Cash Holding (%)	13.953	17.450	-3.465	0.455
G-Index	9.394	8.905	0.498	0.178
Fraction of Independent Directors	0.712	0.716	-0.004	0.564
CEO&Chairman	0.701	0.645	0.058	0.012

Appendix 2.E: The Effects of Home Equity Shock on Skilled Labor Risk

The home equity shock is defined as the yearly change in the national house price index from the Federal Housing Finance Agency divided by the topological elasticity of housing supply in an MSA. We expect that positive (negative) shocks to household home equity in an area would facilitate (hinder) labor mobility (of home owners). Thus the home equity shock is expected to be positively related to local firms' skilled labor risk. However, the challenge we face is that once a firm starts to disclose skilled labor risk in its 10Ks in the post SEC Regulation S-K Item 305(c) period (i.e., after 2005), the value of the skilled labor risk measure does not vary much over time. This is possibly due to concerns of litigation risk. In areas with lower elasticities of housing supply, the housing prices increased more under the long rising national house price trend, leading to higher labor mobility and higher skilled labor risk for firms in those areas. When the positive house price trend turned to negative in 2008 (which is post the SEC regulation), those areas with lower elasticities of housing supply experienced larger drops in house prices. But we may not see a larger decrease in the value of our skilled labor risk measure in those areas due to the rigidity in the measure post the SEC regulation. This problem could even lead to a negative relation between home equity shock and firms' Skilled Labor Risk during years of negative home equity shocks. In the table below, we show that the data support our intuition. In the full sample, there is a significantly positive relation between Home Equity Shock and Skilled Labor Risk. But the positive relation is concentrated in the years of rising housing prices in the country. In the years with negative home equity shocks, the relation turns to negative, consistent with our discussion above. However, if we examine the probability of a firm initiating discussion about skilled labor risk in its 10K post 2007 (i.e., the value of Skilled Labor Risk increases from zero to positive), then we do find a significantly positive relation between Home Equity Shock and the probability of initiation in the housing market downturn. In areas with more negative home equity shocks, firms are less likely to start to concern about skilled labor mobility. Overall, the results in this table suggest that Home Equity Shock can be a valid instrument for our measure of firms' skilled labor risk, but only in periods with positive home equity shocks.

The Effects of Home Equity Shock on Skilled Labor Risk

This table reports the effects of home equity shock on our measure of firms' skilled labor risk. Home equity shock is the yearly change in the national house price index the Federal Housing Finance Agency divided by the topological elasticity of housing supply in an MSA. The dependent variable in the first three columns is Skilled Labor Risk. The dependent variable in the last column is Initiation of Skilled Labor Risk Discussion, which is a dummy variable equal to one if the year of a firm's first-time discussion about skilled labor risk is in or after 2007 and zero otherwise. The sample in the last column includes only the post-2007 period and excludes firms that initiated the skilled labor risk discussion in 10Ks before 2007. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	Full Sample	Home Equity Shock>0	Home Equity Shock<0	Post-2007
Dependent Variable:	Skilled Labor Risk	Skilled Labor Risk	Skilled Labor Risk	Initiation of Skilled Labor Risk Discussion
Home Equity Shock	6.551***	11.121***	-14.139***	0.308**
	[0.804]	[1.138]	[2.351]	[0.149]
Log(Assets)	0.194***	0.190***	0.189***	-0.009*
	[0.019]	[0.018]	[0.032]	[0.005]
Log(1+FirmAge)	-0.676***	-0.673***	-0.606***	0.036***
	[0.045]	[0.043]	[0.078]	[0.011]
ROA	-0.000	0.038	-0.061	-0.054**
	[0.094]	[0.094]	[0.194]	[0.024]
Market to Book	0.055***	0.061***	0.014	-0.002
	[0.014]	[0.014]	[0.033]	[0.004]
Sales Growth	0.160***	0.148***	0.225***	0.017***
	[0.021]	[0.022]	[0.057]	[0.005]
R&D	0.183***	0.176***	0.197***	-0.004
	[0.024]	[0.023]	[0.050]	[0.005]
R&D Missing	-0.490***	-0.482***	-0.487***	-0.040*
	[0.089]	[0.085]	[0.161]	[0.024]
Tangibility	-2.432***	-2.197***	-2.603***	0.252***
	[0.205]	[0.189]	[0.394]	[0.058]
Intangible Assets	-0.544***	-0.493***	-0.484	0.220***
	[0.202]	[0.190]	[0.352]	[0.046]
Sales Vol.	0.347***	0.375***	0.367	0.109***
	[0.096]	[0.096]	[0.229]	[0.031]
Capex	4.094***	3.837***	4.731***	-0.161
	[0.450]	[0.441]	[1.012]	[0.121]
SIC2 FE & Yr FE	Y	Y	Y	Y
Adj. R^2	0.311	0.319	0.210	0.079
N	58740	46171	12569	12333

Appendix C

Chapter 3 Appendices

Variable Definitions

Variable	Definition
Hedging Dummy	A dummy variable equal to one if a firm engages in derivative hedging for foreign currency or commodity price risk in a year and zero otherwise. Source: Corporate 10-K filings in EDGAR database.
# of Mentions	Number of keywords a firm mentions about derivative hedging for foreign currency or commodity price risk in the 10-K in a year. Source: Corporate 10-K filings in EDGAR database.
Unionization	A dummy variable equal to one if a firm mentions some fraction of employees are covered by CBAs. Source: Corporate 10-K filings in EDGAR database.
Union Coverage Rate	Union coverage rate reported in the Item 1 “Business" in the 10-K in a year. Source: Corporate 10-K filings in EDGAR database, Compustat, and author’s calculation.
Log(Sales)	Natural logarithm of sales: Log(SALES). Source: Compustat.
Tangibility	Property, Plant and Equipment/total assets: PPENT/AT. Source: Compustat.
ROA	Operating income before depreciation/total assets: OIBDP/AT. Source: Compustat.
Market to Book	(Equity value+total assets-book equity)/total assets: (PRCCF_F×CSHO+AT-CEQ)/AT. If CEQ<0, we set it as missing. Source: Compustat.
Leverage	Total debt/(Total debt+book equity): (DLC+DLTT)/(DLC+DLTT+CEQ). If CEQ<0, we set it as missing. If the calculated leverage is larger than one, we set it as one. Source: Compustat.
Quick Ratio	Cash and short-term investment/current liability: CHE/LCT. Source: Compustat.
R&D	Research and development expense/total assets: XRD/AT. If XRD is missing, we set it as zero. Source: Compustat.
R&D Missing	A dummy variable equal to one if XRD is missing in Compustat and zero otherwise. Source: Compustat.
Modified Zscore	Modified Altman’s Zscore: (3.3×(IB+TXT+XINT)+SALE+1.4*RE+1.2*(ACT-LCT))/AT. Source: Compustat.
Cash Holding	Cash and short-term investment/total assets: (CHE/AT). Source: Compustat.
Non-debt Tax Shield	Depreciation/total assets: DP/AT. Source: Compustat.
Inventory	Inventory/costs of goods sold: INVT/COGS. Source: Compustat.
Trade Credit	Account payables/total assets: AP/AT. Source: Compustat.
Foreign Sales	Foreign sales/total sales. Source: Compustat.
Industry-level Labor Skill	Fraction of employees with high levels of skill. Source: **?**.
Non-Compete Enforcement	Non-compete covenants enforcement index. Data are available until 2004. Source: Garmaise (2011).

Variable	Definition
IDD	Adoptions of Inevitable Disclosure Doctrine by state courts. Source: Klasa et al. (2016).
Real Estate Transfer Tax Rate	Real Estate Transfer Tax Rate . Source: Checkpoint Database and Lincoln Institute of Land Policies.

Commodity Derivative Hedging Keyword List

A firm is defined to use commodity hedging if it mentions at least item in the following list. The keyword list follows Almeida et al. (2016).

hedge fuel
fuel hedge
fuel call option
commodity derivative
commodity contract
commodity forward
commodity future
commodity hedge
commodity hedging
commodity option
commodity swap
hedges of commodity price
uses derivative financial instruments to manage the price risk
uses financial instruments to manage the price risk
uses derivative financial instruments to manage price risk
uses derivatives to manage the price risk
uses derivatives to manage price risk
forward contracts for certain commodities
forward contracts for commodities
derivatives to mitigate commodity price risk
futures to mitigate commodity price risk
options to mitigate commodity price risk
swaps to mitigate commodity price risk
corn future
cattle future
commodity price swap

Additional Results for the Model

Proof for footnote 2

$$h^* = 1 + \frac{1}{\omega_0 - \bar{W} l_0} \frac{E[\frac{\alpha C_{ee} f_l}{\bar{W}^2 C_{ee} - \theta f_{ll} + \eta}]}{E[\frac{C_{ee}(\theta f_{ll} - \eta)}{\bar{W}^2 C_{ee} - \theta f_{ll} + \eta}]} \tag{C.1}$$

can be simplified to

$$h^* = 1 + \frac{\alpha_0}{\omega_0 - \bar{W} l_0} \frac{E[\frac{P_{\omega\omega} f_l}{\theta f_{ll} - \eta}]}{E[P_{\omega\omega}]}.$$

Proof: we utilize Equations (1) and (2) in the paper. Taking a derivative with respect to ω on both sides of Equation (2), we have

$$P_{\omega\omega} = C_{ee}(\bar{W} \frac{\partial l_1}{\partial \omega} - 1). \tag{C.2}$$

Taking a derivative with respect to ω on both sides of Equation (1), we have

$$\theta f_{ll} \frac{\partial l_1}{\partial \omega} - \eta \frac{\partial l_1}{\partial \omega} = \bar{W} C_{ee}(\bar{W} \frac{\partial l_1}{\partial \omega} - 1). \tag{C.3}$$

By substituting Equation (C.3) into Equation (C.2), we have

$$P_{\omega\omega} = \frac{C_{ee}(\theta f_{ll} - \eta)}{\bar{W}^2 C_{ee} - (\theta f_{ll} - \eta)}. \tag{C.4}$$

Henceforth, Equation (C.1) can be simplified as

$$h^* = 1 + \frac{\alpha_0}{\omega_0 - \bar{W} l_0} \frac{E[\frac{P_{\omega\omega} f_l}{\theta f_{ll} - \eta}]}{E[P_{\omega\omega}]}. \tag{C.5}$$

Proof for Proposition

Proof: We assume that the production function is linear: $f(l) = l$ and the cost function is quadratic: $C(e) = \frac{c}{2} e^2$ to solve the model analytically. From Equation (3.7), we have

$$h^* = 1 - \frac{\alpha_0}{\omega_0 - \bar{W} l_0} \frac{1}{\eta}. \tag{C.6}$$

From Equation (1), we have

$$l_1 = \frac{1}{\eta + \bar{W}^2 c}(\theta - \bar{W} + c\bar{W}\omega + \eta l_0) \tag{C.7}$$

$$E[l_1] = \frac{1}{\eta + \bar{W}^2 c}(1 - \bar{W} + c\bar{W}(\omega_0 - \bar{W}l_0) + \eta l_0). \tag{C.8}$$

Using Equation (3.9) and Equation (C.8), we have

$$l_0 = \frac{2(1 - \bar{W} + c\bar{W}\omega_0)}{\eta + 5c\bar{W}^2}. \tag{C.9}$$

Initial wealth ω_0 must also be large enough to get an interior solution

$$\omega_0 \geq \frac{2\bar{W}(1 - \bar{W})}{\eta + 3c\bar{W}^2}. \tag{C.10}$$

Henceforth, the final expression for the optimal hedge ratio is

$$h^* = 1 - \frac{\alpha_0}{\eta} \frac{\eta + 5c\bar{W}^2}{(\eta + 3c\bar{W}^2)\omega_0 - 2\bar{W}(1 - \bar{W})} \tag{C.11}$$

$$\frac{\partial h}{\partial \eta} = \frac{\alpha_0}{\eta} \frac{1}{(\eta + 3\bar{W}^2)\omega_0 - 2\bar{W}(1 - \bar{W})}[1 + \frac{5c\bar{W}^2}{\eta} + \frac{2c\omega_0\bar{W}^2 + 2\bar{W}(1 - \bar{W})}{(\eta + 3c\bar{W}^2)\omega_0 - 2\bar{W}(1 - \bar{W})}] > 0. \tag{C.12}$$